This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

NYPL RESEARCH LIBRARIES
3 3433 06907618 4

THE MARINE ENGINEER;

A MONTHLY JOURNAL OF

MARINE ENGINEERING, SHIPBUILDING,
STEAM NAVIGATION & ELECTRICAL ENGINEERING.

EDITED BY WILLIAM GEORGE NEAL,
Assoc. I.N.A.

Vol. XXI.—From April, 1899, to March, 1900.

London:
OFFICE FOR ADVERTISEMENTS AND PUBLICATION, 3, AMEN CORNER,
PATERNOSTER ROW, E.C.

1900.

THE NEW YORK
PUBLIC LIBRARY
200782
ASTOR, LENOX AND
TILDEN FOUNDATIONS.
R 1900. L

INDEX.

EDITORIAL NOTES.

Amalgamation of all Naval Officers on board a Battleship, 1
Abnormal Stresses set up in the Plating, 49
Accident Insurance Business, 483
Actual Performance of Vessels under varying Conditions, 2
Adaptability of the Turbine System to Vessels of large size, 382
Americans and Submarine Torpedo-boats, 381
American Workmen and Labour-saving Tools, 241
American Yards seriously competing with British, 382
Anti-frictional value of Roller-bearings, 182
Apportionment of Damage between two Vessels in Collision, 182
Armour v. Guns, 382
Atlantic Cargo Steamers. Large, 181
Battleship, Launch of a, 241
Belfast and Messrs. Harland and Wolff, 242, 337
Berthon, Rev. Edward Lyon, 381
Boilers, Strength of, 2
Building of Ice-breakers, 485
"Bullfinch" Disaster, 183, 337
Calculation of Mid-ship and other Cross-section Areas, 49
Cargo-boat Machinery, Twenty Years of Progress in, 529
Circulation of Water in Boilers, 98
Collapsible Boat, the Berthon, 381
Comparison between the Performances of two Steamships 98
Compensation Act, Some Recent Decisions, 483
Competition of Colonial or Foreign Coalfields, 145
Connecting Rods in High-speed Engines, 337
Cylindrical v. Water-tube Boilers, 50, 530
Danish Ships, Some Steam Trials of, 2
Deadweight saved in an Atlantic Liner, 290
Dearth of Information as to Failures and Breakdowns, 425
Deck-plating, Shearing Stresses on the, 49
Development of Steam Turbines, 529
Disadvantages meted out to the Engineering Branch of the Royal Navy, 97
Disastrous Explosion on Board the T.B. Destroyer "Bullfinch," 183, 337
Distribution of Pressure over the Bottom of a Ship in Dry Dock and over the Dock Blocks, 181
Economy of Coals of the Schichau Engines, 99
Employees Short-sightedness, 242
Employers' Liability Insurance, 483
Engineer Corps of the United States Navy, 1
"Ermack," Ice-breaking Steamer, 485
Essentials for Large Cargo Steamers for the Atlantic, 181
Experimental Upper Turrets on U.S. Battleships, 338
Experiments on the Heat-absorption Power of Water, 98
Failures and Breakdowns, Experience as to, 425, 529
Far-reaching effects upon Marine Engineering Construction, 290
Forced Draught, a new method of, 181
Foreign Coalfields, 484
Fractures to Propeller Shafts, 181
Frictional Resistance of the Ordinary Collar-and-Ring Thrust-block, 182
"Fulda" Accident, The, 181
Graduates of Cambridge University and Engineering, 426
Hamburg-American Company's Yacht for First-class Passengers, 337
Harbour Commissioners of Belfast and Messrs. Harland and Wolff, 242, 337
Haythorn Water-tube Boiler on Passenger Steamers, 145
Heat-absorption Power of Water, Experiments on the, 98
High Rates of Speed, 241, 382
"Holland" Submarine Torpedo-boat, The, 381
Horse-power absorbed by Skin Friction and Wave Making, 50
Ice-breakers for Russia, 485
Important Decisions under the Compensation Act, 483
Increase of Size and Speed in War Vessels, 289
Insurance Rates in the Shipbuilding Trade, 483
Interesting Details of the "Turbinia," 382
International Maritime Conference, 182
Inventions and Improvements introduced in the U.S. between 1807 and 1850, 49
"Kearsage" and "Kentucky," U.S. Battleships, 338
Labour-saving Tools, Improvements in, 241
Large Atlantic Cargo Steamers, 181
Latest Products of the American Constructors' Skill, 338
Launch of a Battleship, 241
Limits of Over-sea Speed, 289
Local Industry in Ireland, 242, 337
"Lorna Doone" fitted with Water-tube Boilers, 145
Manacles Rocks, Stranding of the "Paris" on the. 97
Marine Engineering and Shipbuilding. Improvements in, 289
Maritime Conference, International, 182
Mechanical Inventions of Mr. Berthon, 381
Method of Performing Ship Calculations, 49
Motive Power. High-speed Steam Turbines, 529
Mounting of Naval Guns for Land Service, 530
Mumford Water-tube Boiler, 145
Naval Engineers and the War, 425
Newport News Shipbuilding Yard, 241
Novelty in the Construction of the "Kearsage" and "Kentucky," 338
Official Test of the "Holland" Submarine Torpedo-boat, 381
Output of Coal in the United States, 484
"Paris," Stranding of the. 97
Parsons Turbine Engine, 241, 382, 529
Performances of two Steamships. Comparison between the, 98
Perils of the Engine-room, The, 183, 337
Personnel of the United States Navy, 1
Possibilities of Forced Draught, 181
Possibilities of Ocean Navigation, 290
Practical Experience of the Strength of Boilers, 2
Pressure on Dry Dock Blocks, 181
Principles and the Work involved in the Launch of a Large Battleship, 241
Probabilities of Increased Steam Pressure, 290
Promotion of Engineer Officers in the Royal Navy, 97
Propelling Apparatus in a Destroyer, 289
Propulsion of Triple-screws, 426
Recognition for the Services of the Engineering Branch of the Royal Navy, 425
Recognition of Naval Engineers as a Royal Military Corps, 97
Relative Value of South African Coal, 145
Reminiscences of Early Steam Engines and Steam Navigation in the U.S., 49
Requirements of Engineering Employers, 426
Responsibility of Shipowners, 182
Scarcity and High Price of Coal, 484
Sea-going Engineers reticent of their Experiences, 425, 529
Serious Disaster to an Atlantic Liner, 97
Shipbuilding in the North of England and Scotland, 242
Skin Friction and Wave Making, Horse Power absorbed by, 50
Some Steam Trials of Danish Ships, 2
South African Coalfields. 145
Splendid Services rendered by Naval Engineers, 425
Steam Navigation at High Speeds, 289
Steering and Control of Torpedoes, 146
Strength of Boilers, 2
Strength of Connecting Rods, 337
Stresses in a Ship's Structure, 49
Submarine Torpedo-boats, 381
Surface Resistance of Vessels, 290
System of Forced Draught, 181
Thrust-block Friction, On, 182
Time and Money wasted by Shipbuilding Employees, 242
Torpedo-boat Destroyers, 99
Torpedo-boat Destroyers for Sea Service, 50
Torpedo-boats and High Speeds. 289
Torpedoes controlled by Invisible Rays, 146
Transmitting Motive Power by means of Light, 146
Trials of Vessels under different Conditions, 2
Triple-screw Propulsion, 426
Tubes of Water-tube Boilers, 530
"Turbinia," Speed of the, 290, 529
Turbo-motor Rotary Engine, 290
Twenty Years of Progress in Cargo-boat Machinery, 529
Type of Rod used in the "Bullfinch," 337
Types of Water-tube Boilers, 145
United States Navy and Engineers, 1
University Training and Engineering, 426
War Vessels, Increase of Speed in, 289
Water-tube Boilers and Turbine Engines, 241, 382
Water-tube Boilers in Passenger Steamers, 145
Wave Resistance, Increased, 290
Weight, Length and Speed of Vessels, 289
White, Sir William, on Steam Navigation at High Speeds, 289
Workmen's Compensation Act in Relation to the Shipping Trade, 483
Yacht for First-class Passengers, A new, 337
Yerrow Water-tube Boiler, 145

ILLUSTRATED ARTICLES.

Adjustable Lathe Mandrel, The X.L., 69
Ailsa Shipbuilding Co.'s New Graving Dock, 211
Air Compressors for Belt Driving, 110
Air-compressing Engine, 362
Air-pump, Drake's, 440
American Liner "Paris," 109
"Arcturus," Four Views on Board the R.M.S., 77 (double-page plate supplement)
"Argonaut," Trials and Experiments made in H.M.S., 53
Austrian Torpedo-boats, The, 26 (with double-page plate illustration)
Automatic Fairy Boiler Feeder, 221
Automatic Plug-making Machine, 435
Automatic Throttle Valve, Patent. 497
Babcock & Wilcox Marine Boiler, The, 387
Balanced Piston-Valve and its Application to Four-Crank Engines, A New, 530
Balancing of Engines, The, 17
Bearings for Propeller Shafting, 400
Bearing, The Mossberg Patent Thrust, 291, 492
Berth for Two Persons, First-class, on board R.M.S. "Arcturus," 77 (plate supplement)
Bickford Burner Co.'s Liquid Fuel Crucible Furnace, 131
Blackman Ventilating Co., The, 255
Boiler Arrangements of Certain Recent Cruisers, On the, 183
Boiler-room in the U.S. Cruiser "Chicago," 387
Boiler-shop, Messrs. Easton, Anderson and Goolden, Ltd., 307
Boiler, Water-tube, 503
Bulkhead Door for Ships' Holds, Watertight 252
Bull's Metal Propellers, 346
Burner for Industrial Purposes, 85
Cable Machinery for H.M.S. Cable Ship "Monarch," 362
Cable Steamer "Von Podbielski," Twin-Screw, 480
Casualties to Steam Pipes, 7
"Chicago," U.S. Cruiser, 387
Clyde Passenger Paddle Steamer "Waverley," The, 310
Clyde Piston Ring, The, 74
"Cobra," First-class Torpedo-boat, 26 (with double-page plate illustration)
Compensating Split Packing, 116
Compressed-air Machinery, 110
Copper Jointings. Seamless, 403
Cork Insulation, Nonpareil, 438
Cornish's Marine Sounding Machine, 499
Cowper-Coles Magnetic Scale Collector, 254

Cowper-Coles Sound Locator and Projector, 347
Crawford's Patent Watertight Bulkhead Door for Ships' Holds, 252
Crosby Indicators, 150
Crucible Furnace, Liquid Fuel, 131
Cunliffe & Croom's Duplex Vertical Milling Machine, 158 (with page plate supplement)
Cylindrical Marine Water-tube Boiler, Drake's, 443
Daimler Oil Motor, 119
"Danske-Tre," Self-trimming Lighter, 220
Deck Planer, Electric, 339
Diagrams from Triple-expansion Engines, Some interesting, 168
Door Hook and Eye, An Improved, 538
Drake's Air Pump, 140
Drake's Bearings for Propeller Shafting, 400
Drake's Cylindrical Marine Water-tube Boiler, 443
Drilling, Boring, Tapping and Milling Machine, Radiating, 257
Drilling Machines, Electric, 338
Drop Rudder, Patent, 882
Dry Dock at Limehouse, The New Union, 263
Duncan's Patent Automatic Throttle Valve, 497
Duplex Vertical Milling Machine, 158 (with page plate supplement)
Durston, Sir John, On Trials and Experiments made in H.M.S. "Argonaut," 53
Dynamo Testing Shop, Messrs. Johnson & Phillips, 350
East Asiatic Co.'s S.S. "Korea," 505
Easton, Anderson & Goolden, Ltd., 307
Edson Recording Gauge, The, 532
Electric Deck Planer, 339
Electric Drilling Machines, 338
Electric Fan, 364
Electricity in Shipbuilding Yards, Some notes on the application of, 338
Electric Launches, "Vril," 266
Electro-Magnetic Separator, Patent, 384
Emigrants' Berth on Board R.M.S. "Arcturus," 77 (double-page plate supplement)
Engines of S.S. "Manchester Corporation," 158 (with page plate supplement)
Engines, The Balancing of, 17
Engine, The "Petter" Petroleum, 299
Estler Bros., Improved Ships' Lamps, 397
Expansion Gland for Steam Pipes, 304
Experiments having Reference to the Durability of Water-tube Boilers, Some, 201
Experiments on the Heat-absorption Power of Water, 99
Fans for Ventilating, 255
First-class Battleship "Vengeance," 152
First-class Saloon on Board R.M.S. "Arcturus," 77 (double-page plate supplement)
Fletcher, Son & Fearnall, Limited, Union Docks, Limehouse, 263
Forced Draught, Gosling's, 146
Fox Tube or Pipe Cutting Machine, The, 888
Friedmann's Patent Re-starting Injectors, 69
Friedmann's Sight-feed Lubricators, 66
Gauge, Recording, 532
Gauge, Viles' Patent Water, 60
Gland for Steam Pipes, Expansion, 304
Gosling's Forced Draught, 146
Graving Dock, Ailsa Shipbuilding Co.'s New, 211
Heat-absorption Power of Water, Experiments on the, 99
Heating Devices, Simple, 296
"Hezzanith" Parallel Rule, The, 64
Holden & Brookes' "Sirius" Pulsating Pump, 209
Homacoustic System of Voice Tubes, 268
Hook and Eye, An Improved Door, 538
Hose Union, "Storz" Patent, 213
Hulburd's Seamless Copper Jointings, 403
"Ikadsuchi," Torpedo-boat Destroyer, 3
Indicator for Steam Engines, A Continuous Mean-Pressure, 426, 510
Indicators, Crosby, 150
Injectors, Friedmann's Re-starting, 69
Installations, Compressed Air, 110
Institution of Engineers and Shipbuilders in Scotland, Paper read before the, 530
Institution of Mechanical Engineers, Papers read before the, 243, 426
Institution of Naval Architects, Papers read before the, 7, 53, 183, 201
Japanese Torpedo-boat Destroyer "Ikadsuchi," 3
Japanese Torpedo-boat Destroyer "Murakumo," The, 53
Johnson & Phillips, 350
Kerosene Combination Hot-blast Hand-brazer, 296
"Korea," The S.S., 505
Lamps, Improved Ships', 397
"Lancaster" Patent Piston-Valve Packing, 538
Lathe Mandrel, The X.L. Adjustable, 69
Launches, "Vril" Electric, 266
Launch for the War Office Submarine Mine Service, 166
Lighters for Self-Trimming, New Steel, 220
Liquid Fuel Crucible Furnace, 131
Lubricators, Sight-feed, 66
Machinery of H.M.SS. "Proserpine" and "Psyche," 243
Machine Shop, Messrs. Easton, Anderson & Goolden, Ltd., 307
Machine Shop, Messrs. Johnson & Phillips, 350
Magnetic Scale Collector, Cowper-Coles, 254
"Manchester Corporation," Engines of S.S., 158 (with page plate supplement)
Mandrel, The X.L. Adjustable Lathe, 69
Marine Boiler, the Babcock & Wilcox, 387
Marine Oil Motor, Priestman's, 119
Marine Sounding Machine, A New, 499
Marshall, F. T., On the Boiler Arrangements of certain recent Cruisers, 183
Mayston, Mr. Robert, R.N., On the Machinery of H.M.SS. "Proserpine" and "Psyche," 243
Mean-Pressure Indicator for Steam Engines, A continuous, 426, 510
Milling Machine, Duplex Vertical, 153 (with page plate supplement)
Milton, Mr. J. T., On Steam Pipes, 7
Moeller & Condrup's New Burners, 85
Mossberg Patent Thrust Bearing, The, 291, 492
Multiple-Expansion Engines, Receiver Drop in, 485
"Murakumo," The Japanese Torpedo-boat Destroyer, 53
Neville Bros. Drilling, Boring, Tapping and Milling Machine, 257
Nonpareil Cork Insulation, 488
North British Steam Packet Co.'s P.S. "Waverley," The, 310
North-East Coast Institution of Engineers and Shipbuilders, Paper read before the, 485
Nottingham Universal Automatic Fairy Boiler Feeder, The, 221
O'Brien, Mr. William, on a New Balanced Piston-Valve and its Application to Four-crank Engines, 530
Oil Engines, 102
Oil Launch, 865
Oil Motor Boats, 119
On the Boiler Arrangements of certain Recent Cruisers, 183
"Oriental" Dry Dock and Works, Shanghai, 310
Packing, Compensating Split, 116
Papers read before the Institution of Naval Architects, 7, 53, 183, 201
"Paris," The stranded, 109
"Petter" Petroleum Engine, The, 299
Phillips's Water tube Boiler, 503
Pipe-cutting Machine, The Fox Tube or, 383
Pipes, Steam, 7
Piston Ring, The Clyde, 74
Piston-Valve and its Application to Four-crank Engines, A New Balanced, 530
Piston-Valve Packing, An Improved, 538
Platts & Lowther's Patent Compensating Split Packing, 116
Plug-making Machine, Automatic, 435
Priestman's Marine Oil Motor, 119
Propellers, Bull's Metal, 346
Propeller Shafting, Bearings for, 400
"Proserpine" and "Psyche," Machinery of H.M.SS., 243
Pulsating Pump, The "Sirius," 209
Radiating, Drilling, Boring, Tapping and Milling Machine, 257
Receiver Drop in Multiple-Expansion Engines, 485
Recording Gauge, The Edson, 532
Re-starting Injectors, Friedmann's, 69
Reversible Propeller, Patent, 102
Ripper, Prof. William, On a Continuous Mean Pressure Indicator for Steam Engines, 426, 510
Roller Thrust Block, Mossberg's Patent, 291, 492
Rudder, Patent Drop, 382
Rule, The "Hezzanith" Parallel, 64
Russian Dredger, "Titus Edrigevitch," 84
Scale Collector, Magnetic, 254
Seamless Copper Jointings, 403
Separator, Patent Electro-Magnetic, 384
Shanghai Engineering, Shipbuilding and Dock Co.'s "Oriental" Dry Dock and Works, Shanghai, The, 310
"Sheldrake," H.M.S., Fitted with four Babcock & Wilcox Boilers, 387
Shipbuilding and Docking Facilities of Troon, 211
Shipbuilding Yards, Some Notes on the Application of Electricity in, 338
Ship Lighting Set, Messrs. Johnson & Phillips, 350
Ships' Lamps, Improved, 397
Sight-feed Lubricators, Friedmann's, 66
Simple Heating Devices, 296
Simpson, Strickland & Co., 542
"Sirius" Pulsating Pump, The, 209
Smith & Wilford's Automatic Fairy Boiler Feeder, 221
Smoke Room, A corner of the, on board R.M.S. "Arcturus," 77 (with plate supplement)
Some Experiments having Reference to the Durability of Water-tube Boilers, 201
Some Interesting Diagrams from Triple-Expansion Engines, 168
Sounding Machine, A New Marine, 499
Sound Locator and Projector, Cowper-Coles, 347
Special Machine Tool for Shipbuilding Requirements, 153 (with page plate supplement)
Steam Engines, A Continuous Mean-Pressure Indicator for, 426, 510
Steam Pipes, 7
Steam Pipes, Expansion Gland for, 304
Steam Trap, The Thermoscopic Loop, 401
Steel Lighters for Self-trimming, New, 220
Stone & Co.'s Automatic Plug-making Machine, 435
"Storz" Patent Hose Union, The, 213
Taylor's Patent Door Hook and Eye, 538
Teak Launch, Copper Sheathed, with five B.H.P. Balanced Engines, 163
Thermoscopic Loop Steam Trap, The, 401
Thornycroft, John I. & Co., 51
Throttle Valve, Patent Automatic, 497
Thrust Bearing, The Mossberg Patent, 291, 492
"Titus Edrigevitch," The Dredger, 84
Tolch & Co., of Fulham, 102
Torpedo-boat Building on the Thames, 51
Torpedo-boat Destroyers, 3, 53
Trials and Experiments made in H.M.S. "Argonaut," 53
Triple-Expansion Engines of S.S. "Manchester Corporation," 158 (with page plate supplement)
Triple-Expansion Engines, Some interesting Diagrams from, 168
Triple-Expansion Launch Engines, 542
Tube or Pipe-cutting Machine, The Fox, 383
Tubes, Homacoustic System of Voice, 268
Twin-Screw Cable Steamer "Von Podbielski," 480
Union Docks, Limehouse, 263
"Vengeance," H.M.S., 152
Vertical Petroleum Engine, 299
Vile's Patent Water Gauge, 60
Voice-Tubes, System of, 268
"Von Podbielski," Twin-Screw Cable Steamer, 480
"Vril" Electric Launches, 266
Water Gauge, 60
Watertight Bulkhead Door for Ships' Holds, Crawford's Patent, 252
Water-tube Boiler, Cylindrical Marine, 443
Water-tube Boiler, Phillips's, 503
"Waverley," The Clyde Passenger Paddle Steamer, 310
Weighton, Prof. R.L., On Receiver Drop in Multiple-Expansion Engines, 485
X.L. Adjustable Lathe Mandrel, The, 69
Yarrow, A. F., On the Durability of Water-tube Boilers, 201
Yarrow-Schlick-Tweedy System of Balancing of Engines, 17

GENERAL INDEX.

Additions to the Fleet, 509
Adjustable Lathe Mandrel, The X.L., 69
Ailsa Shipbuilding Co.'s New Graving Dock, 211
Air-compressing Engine, 362
Air Compressors for Belt Driving, 110
Air Pump, Drake's, 440
American and Swedish Navy Estimates, The, 23
American Liner "Paris," 109
"Amphitrite," The Trials of the, 73
Appointments, Naval Engineer, 31, 78, 123, 160, 224, 272, 316, 356, 405, 467, 513, 549
"Arcturus," Four Views on Board the R.M.S., 77
"Argonaut," Trials and Experiments made in H.M.S., 53, 66
Armour, A New Process for Making, 22
Armour Plate, A New, 301
Austrian Navy, The, 445
Austrian Torpedo Boats, The, 26
Automatic Fairy Boiler-Feeder, The Nottingham Universal, 221
Automatic Plug-Making Machine, 435
Automatic Throttle Valve, Patent, 497
Babcock & Wilcox Marine Boiler, The, 387
Balanced Piston-Valve and Its Application to Four-crank Engines, A New, 580
Balancing of Engines, The, 17
Bearings for Propeller Shafting, 400
Bearing, The Mossberg Patent Thrust, 291, 492
Beresford, Lord Charles, and the Engineers' Grievances, 114
Bickford Burner Co.'s Liquid Fuel Crucible Furnace, 131
Blackman Ventilating Co., The, 255
Boiler Arrangements of Certain Recent Cruisers, On the, 183, 193
Boiler Room in the U.S. Cruiser "Chicago," 387
Boiler Shop, Messrs. Easton, Anderson & Goolden, Limited, 307
Boilers, The Strength of, 68
Boiler, Water-tube, 503
Boyd, Mr. J.W., on Repairs to Hulls and Machinery of Modern Steamships, 534
"Brief" for the Engine-room Artificers, The, 23
British and French Squadrons in Italian Waters, The, 73
Broken Shaft was Repaired, How a, 314
Buenos Ayres Harbour Works, 65
Bulkhead Door for Ships' Holds, Watertight, 252
Bull's Metal Propellers, 346
"Bulwark," The Launch of the, 349
Burner for Industrial Purposes, 85
Cable Machinery for H.M.S. Cable Ship "Monarch," 362
Cable Steamer "Von Podbielski," Twin-Screw, 480
Canadian Nickel Steel for British Warships, 445
"Canopus" on Trial, The "Ocean" and, 262
Cargo Steamers, Large Atlantic, 196
Casualties to Steam Pipes, 7, 67
Cervera's, Admiral, Dash from Santiago, 509
Charity for the Navy, 304
Chatham Dockyard, 22, 72, 114, 156, 215, 261, 303, 349, 396, 446, 509, 541
Cheating the Government, 396
"Chicago," U.S. Cruiser, 395
Civil Engineers, Paper read before the Institution of, 28
Clyde Passenger Paddle Steamer "Waverley," The, 310
Clyde Piston Ring, The, 74
Coaling at Sea, 260, 303
Coaling Feats, Smart, 215
Coal Consumption of the "Canopus" and "Ocean," 303
Coal Prospects, Western Australian, 254
Coal Used by the Victorian Naval Defence, The, 156
"Cobra," First-class Torpedo Boat, 26
Cochran & Company's New Boiler and Shipbuilding Works, 440
Collisions at Sea, Prevention of, 4
Colomb, The Late Admiral, 350
Compensating Split Packing, 116
Compressed Air Machinery, 110
Conduct of the Navy, The, 394
Contractors' Penalties, 216
Contracts and Penalties, 70
Copper Jointings, Seamless, 403
Cork Insulation, Nonpareil, 488
Cornish's Marine Sounding Machine, 499
Cowper-Coles Magnetic Scale Collector, 254
Cowper-Coles Sound Locator and Projector, 347
Crawford's Patent Watertight Bulkhead Door for Ships' Holds, 252
"Cressy," The Launch of the, 446
Criticism on the Estimates, The, 20
Crosby Indicators, 150
Crucible Furnace, Liquid Fuel, 131
Cruisers for the United States, New, 394
Cunliffe & Croom's Duplex Vertical Milling Machine, 153
Cylindrical Marine Water-tube Boiler, 443
Daimler Oil Motor, 119
"Danske-Tre," Steel Lighter for Self-trimming Purposes, 220
Deck Planer, Electric, 339
Denny, Peter, LL.D., 30
Devonport Dockyard, 23, 71, 112, 156, 215, 261, 302, 348, 394, 445, 508, 540
Diagrams from Triple Expansion Engines, Some Interesting, 168
Discussion on Papers read before the Institution of Naval Architects, 66
Distribution of Pressure over the Bottom of a Ship in Dry Dock and over the Dock Blocks, 191
Dobson, Mr. J. M., on Buenos Ayres Harbour Works, 65
Door Hook and Eye, An Improved, 538
Drake's Air-Pump, 440
Drake's Bearings for Propeller Shafting, 400
Drake's Cylindrical Marine Water-tube Boiler, 443
Drilling, Boring, Tapping and Milling Machine, Radiating, 257
Drilling Machines, Electric, 338
Drop Rudder, Patent, 383
Dry Dock at Limehouse, The New Union, 222, 263
Duncan's Patent Automatic Throttle Valve, 497
Duplex Vertical Milling Machine, 153
Durston, Sir A. J., K.C.B., R.N., 29
Durston, Sir A. J., and Mr. H. J. Oram, R.N., on Machinery of Warships, 28, 67
Durston, Sir A. J., On Trials and Experiments made in H.M.S. "Argonaut," 53, 66
Dynamo Testing Shop, Messrs. Johnson & Phillips, 350
East Asiatic Co's S.S. "Korea," 505
Easton, Anderson & Goolden, Limited, 307, 352
Edson Recording Gauge, The, 532
Electrical Forge, 342
Electrical Plant of the Battleships "Kearsarge" and "Kentucky," 447
Electric Deck Planer, 339
Electric Drilling Machines, 338
Electric Fan, 364
Electricity on Board Ship, Lieut.-Com. Dana Green on, 25
Electricity in Shipbuilding Yards, Some Notes on the Application of, 338
Electric Launches, "Vril," 266
Electric Motors in the United States Navy, 400
Electric Welding and Brazing, 341
Electro-Magnetic Separator, Patent, 384
Electro-Magnets for Extracting Iron Filings, 340
Electro-Magnets for Lifting Purposes, 340
Elgar, Dr. Francis, on Pressure on Dry Dock Blocks, 191
Elswick Cruisers, 192, 303
Engineers, Grievances of Young, 414
Engines for Warships, 510
Engines of S.S. "Manchester Corporation," 158
Engines, The Balancing of, 17
Engine, The "Petter" Petroleum, 299
Estimates, The Promise of the, 70
Estler Bros. Improved Ships' Lamps, 397
Executive and Engineer, 391
Expansion Gland for Steam Pipes, 304
Experiments Having Reference to the Durability of Water-tube Boilers, Some, 195, 201
Experiments on the Heat-absorption Power of Water, 99
Fans for Ventilating, 255
Feed Pumps, Weir's, 151
First-class Battleship "Vengeance," 152
First Decade, The Institute of Marine Engineers, 29
Fleets of the Mail Lines, The, 14, 61, 106, 147, 205, 250, 292, 342, 385, 436, 493, 535
Fletcher, Son & Fearnall, Limited, Union Docks, Limehouse, 263
Floating of H.M.S. "Glory," 26
Forced Draught, Gosling's, 146
Foundry at Sea, A, 155
Fox Tube or Pipe-Cutting Machine, The, 383
French and English Construction Records, The, 156
French Navy, Building up the, 115
French Navy Estimates, 348
French Navy, The, 22, 217, 260, 444
Friedmann's Patent Restarting Injectors, 69
Friedmann's Sight-Feed Lubricators, 66
Future Development of the Steam Engine, The, 538
Gauge Recording, 532
Gauge, Vile's Patent Water, 60
German Naval Manœuvres, The, 261
German Navy, Building up the, 156, 396, 508
German Navy, Water-tube Boilers in the, 96
German Shipbuilding Programme, The, 541
Gland for Steam Pipes, Expansion, 304
"Glory," Floating of H.M.S., 26
Gordon's Sliding Scales for Shipbuilders, Shipowners, Engineers, and Naval Architects, 546
Goschen, Mr., and the Navy League, 113
Gosling's Forced Draught, 146
Graving Dock, Ailsa Shipbuilding Company's New, 211
Grievances of Young Engineers, 414
Gunnery in the French and English Navies, 350
Guns of the "Handy Man," The, 506
Harbour Works, Buenos Ayres, 65
Heat-Absorption Power of Water, Experiments on the, 99
Heating Devices, Simple, 296
Help for the Widows and Orphans, 444
"Hermes," The Trials of the, 157
"Hezzanith," Parallel Rule, The, 64
"Highflyer" and "Minerva," The Trials of the, 541
Holden and Brooke's "Sirius" Pulsating Pump, 209
"Holland" Submarine Boat, Some Details of the, 302, 314, 447
Homacoustic System of Voice Tubes, 268
Hook and Eye, An Improved Door, 538
"Hooker No. 1," U.S. Army Transport, 118
Hopetoun, Right Hon. the Earl of, Presidential Address, 5
Hose Union, "Storz" Patent, 213
How a Broken Shaft was Repaired, 314
Hulburd's Seamless Copper Jointings, 403
Hunter, Mr. G. B., on Large Atlantic Cargo Steamers, 196
Hydrographer's Report, The, 155
Ice Breakers, 194
"Ikadsuchi," Torpedo-boat Destroyer, 4
Imperial Programme of Work, An, 302
Improved Ships' Lamps, 397
Indicator for Steam Engines, A Continuous Mean-pressure, 426, 510
Indicators, Crosby, 150
Influence of Cheap Fuel on the Cost of Electrical Energy, 504
Injectors, Restarting, 69
Installations, Compressed Air, 110
Institute of Marine Engineers, 24, 76
Institute of Marine Engineers, First Decade, 29
Institution of Civil Engineers, Papers Read before the, 28, 65
Institution of Engineers and Shipbuilders in Scotland, Paper read before the, 530
Institution of Mechanical Engineers, Papers Read before the, 248, 426
Institution of Naval Architects, 4, 189
Institution of Naval Architects, Papers Read before the, 7, 66, 183
Japanese Navy, The Imperial, 21
Japanese Torpedo-boat Destroyer "Murakumo," The, 53

Japanese Torpedo-boat Destroyer, The, 4
Johnson & Phillips, 350
Jules Lothe, The Shooting of, 261
Kaiser in a New Rôle, The, 73
"Kearsarge" and "Kentucky," Electrical Plant of the Battleships,
Kerosene Combination Hot-blast Hand-brazer, 296
"Korea," The S.S., 505
Lamps, Improved Ships', 397
"Lancaster" Patent Piston-Valve Packing, 538
Lathe Mandrel, Adjustable, 69
Launches, "Vril" Electric, 266
Launch for the War Office Submarine Mine Service, 166
Launch of the "Victoria and Albert," 113, 116
Lighters for Self-trimming, New Steel, 220
Limehouse, The New Union Dry Dock at, 222, 263
Liquid Fuel Crucible Furnace, 131
List of Vessels Launched in 1899, 449
Lower-Deck Grievance, A, 347
Lower-Deck to the Quarter-Deck, From the, 157
Lubricators, Sight-Feed, 66
Machinery of H.M Ss. "Proserpine" and "Psyche," 243
Machinery of Warships, 28, 67
Machine Shop, Messrs. Easton, Anderson & Goolden, Limited, 307
Machine Shop, Messrs, Johnson and Phillips, 350
Machine Tool for Shipbuilding Requirements, Special, 153
Magnetic Lathe Chucks, 340
Magnetic Scale Collector, Cowper-Coles, 254
Mail Lines. The Fleets of the, 14, 61, 106, 147, 205, 250, 292, 342, 385, 436, 493, 537
"Maine," To Raise the, 539
"Manchester Corporation," Engines of S.S., 158
Mandrel, Adjustable Lathe 69
Manœuvres and After, The, 257
Marine Engineers, Institute of, 24, 76
Marine Boiler, The Babcock & Wilcox, 387
Marine Engines, Water-tube Boilers for, 28
Marine Oil Motor, Priestman's. 119
Marine Sounding Machine, A New, 499
Marshall, Mr. F. T., on the Boiler Arrangements of Certain Recent Cruisers, 183, 193
Martell, Mr. Benjamin, 256
Mayston, Mr. Robert, R.N., on the Machinery of H.M.SS. "Proserpine" and "Psyche," 243
Mean Pressure Indicator for Steam Engines, A Continuous, 426, 510
Mechanical Stokers, 446
Melville's, Rear-Admiral, Opinion of Naval Engineers, 508
Metallic Packing, 75
Milton, Mr. J. T., on Steam Pipes, 7, 67
Milton, Mr. J. T., on Water-tube Boilers for Marine Engines, 28
"Minerva," The Trials of the "Highflyer" and, 541
Moeller & Condrup's New Burners, 85
Mossberg Patent Thrust Bearing, The, 291, 492
Moss, H. E. & Co.'s Steamship Circular, 355
Multiple-Expansion Engines, Receiver Drop in, 485
"Murakumo," The Japanese Torpedo-boat Destroyer, 53
Naval Architects, Institution of, 4, 189
Naval Brigade for the Cape, A, 348, 506
Naval Engineer Appointments, 31, 78, 123, 160, 224, 272, 316, 356, 405, 467, 513, 549
Naval Engineers, A Pamphlet for, 303
Naval Gunnery, 447
Naval Guns for Field Service, 542
Naval Manœuvres, The, 158, 214
Naval Programmes, Comparisons of, 71
Naval Strength of the Powers, The, 509
Naval Superiority, Our, 115
Naval Works, 72
Navy and South Africa, The, 302, 390, 445, 506
Navy and the Army, The, 540
Navy and Wireless Telegraphy, The, 508, 540
Navy Employment Agency, The Work of the, 115
Navy Estimates, The, 20
Navy League and Our Naval Requirements, The, 540
Neville Bros'. Drilling, Boring, Tapping and Milling Machine, 257
New Navy and the Old, The, 394
Noble, Sir Andrew, on the Rise and Progress of Rifled Naval Artillery 190
Nonpareil Cork Insulation, 438
North British Steam Packet Co's. P.S. "Waverley," The, 310
North-East Coast Institution of Engineers and Shipbuilders, Paper Read before the, 485
Notable Launches, Two, 22
Nottingham Universal Automatic Fairy Boiler-Feeder, The, 221
O'Brien, Mr. William, on a New Balanced Piston-Valve and its Application to Four-Crank Engines, 530
"Ocean" and "Canopus" on Trial, The, 262
"Oceanic," The, 297
Oil Engines, 102
Oil Fuel, The Failure of, 216
Oil Fuel, The Supply of, 72
Oil Launch, 365
Oil Motor Boats, 119
Old Names for New Warships, 21, 155
On the Boiler Arrangements of Certain Recent Cruisers, 183, 193
"Oriental" Dry Dock and Works, Shanghai, 310
Packing, Compensating Split, 116
Packing, Metallic, 75
Paints, Ripolin, 325
Palmer's Shipbuilding and Iron Co., Limited, 199
"Pandora," The Launch of the, 510
Papers Read before the Institution of Civil Engineers, 28, 65
Papers Read before the Institution of Naval Architects, 7, 66, 183
"Paris," The Stranded, 109
Pay of Engineer Officers Abroad, The, 157
Peace Conference and the Red Cross at Sea, The, 157
Pembroke Dockyard, 21, 73, 114, 157, 216, 262, 304, 350, 397, 447, 509, 542
Perils of the Engine Room, The, 217
"*Perthshire,*" *Broken* Shaft of the, 314
"Petter" Petroleum Engine, The, 299
Phillips's Water-tube Boiler, 503
"Pioneer," Launch of H.M.S., 215
Pipe-Cutting Machine, The Fox Tube or, 383
Pipes, Steam, 7, 67
Piston Ring, The Clyde, 74
Piston-Valve and Its Application to Four-Crank Engines, A New Balanced, 530
Piston-Valve Packing, An Improved, 538
Platts & Lowther's Patent Compensating Split Packing, 116
Plug-Making Machine, Automatic, 435
Portable Pneumatic Riveters, 68
Portsmouth Dockyard, 21, 70, 115, 155, 214, 260, 301, 347, 391, 445, 508, 540
"Powerful" and "Terrible," The, 262
Presidential Address, Right Hon. the Earl of Hopetoun, G.C.M.G., 5
Pressure on Dry Dock Blocks, 191
Prevention of Collisions at Sea, 4
Priestman's Marine Oil Motor, 119
Progress of Rifled Naval Artillery, 190
Progress of Steam Navigation, The, 396
"Prometheus," The Trials of the, 216
Propellers, Bull's Metal, 346
Propeller Shafting, Bearings for, 400
"Proserpine" and "Psyche," Machinery of H.M.SS'., 243
Pulsating Pump, The "Sirius," 209
Pumps, Weir's Feed, 151
Queen and the Navy League, The, 445
Radiating, Drilling, Boring, Tapping, and Milling Machine, 257
Re-armament of Old Warships, The, 539
Receiver Drop in Multiple-Expansion Engines, 485
Recording Gauge, The Edson, 532
Refits for 1899, 72
Relative Importance of Guns, Armour, and Speed, The, 349
Removal of Mill Scale by Electricity, The, 340
Repairs to Hulls and Machinery of Modern Steamships, 534
Reversible Propeller, Patent, 102
Rifle Practice in the Navy, 22
Ripolin Paints, 325
Ripper, Prof. Wm., on a Continuous Mean Pressure Indicator for Steam Engines, 426, 510
Roller Thrust Block, Mossberg's Patent, 291, 492
Royal Dockyards Reorganisation Scheme, The, 215
Royal Naval College, The New, 114
Royal Naval Tournament, A, 157
Royal Yacht, The Mishap to the, 506, 541
Rudder, Patent Drop, 383
Rule, The "Hezzanith" Parallel, 64
Russian Dredger "Titus Edrigevitch," 84
Russian Navy, The, 301, 446
Saxon, Mr. Alfred, on the Future Development of the Steam Engine, 538
Scale Collector, Cowper-Coles Magnetic, 254
Scylla's Gunnery Practice, The, 114
Seamless Copper Jointings, Hulburd's, 403
Search, The Right of, 509
Separator, Patent Electro-Magnetic, 384
Shanghai Engineering, Shipbuilding and Dock Co's. "Oriental" Dry Dock and Works, Shanghai, The, 310
Sheerness Dockyard, 22, 72, 113, 157, 216, 262, 302, 349, 396, 446, 510, 541
"Sheldrake," H.M.S., Fitted with Four Babcock & Wilcox Boilers, 387
Shipbuilding and Dock Building Yards of C. S. Swan & Hunter, Ltd., 198
Shipbuilding and Docking Facilities of Troon, 211
Shipbuilding Works, Cochran & Co.'s New Boiler and, 440
Shipbuilding Yards, Some Notes on the Application of Electricity in, 338
Ship Communication, Novel Method of, 215
Ship Lighting Set, Messrs. Johnson & Phillips, 350
Ships' Lamps, Improved, 397
Sight Feed Lubricators, Friedmann's, 66
Signal Books, Missing, 347
Simple Heating Devices, 296
Simpson, Strickland & Co., 542
"Sirius" Pulsating Pump, 209
Skilled Mechanics for the Navy, 348
Sliding Scales, Gordon's, 546
Smith & Wilford's Automatic Fairy Boiler-Feeder, 221
Smokeless Coal to the Navy, The Value of, 541
Some Experiments Having Reference to the Durability of Water-tube Boilers, 195, 201
Some Interesting Diagrams from Triple-Expansion Engines, 168
Some Steam Trials of Danish Ships, 66
Sounding Machine, A New Marine, 499
Sound Locator and Projector, Cowper-Coles, 347
Special Machine Tool for Shipbuilding Requirements,
Speedy Cruisers, 261, 444
Steam Engines, A Continuous Mean Pressure Indicator for, 426, 5
Steam Engine, The Future Development of the, 538
Steam Pipes, 7, 67
Steam Pipes, Expansion Gland for, 304
Steamship Circular, H. E. Moss & Co.'s, 355
Steamships, Repairs to Hulls and Machinery of Modern, 534
Steam Trap, The Thermoscopic Loop, 401
Steel Lighters for Self-trimming, New, 220
Stone & Co.'s Automatic Plug-Making Machine, 435
Story, A Good, 73
"Storz" Patent Hose Union, The, 213
Stresses in a Ship's Structure, 67
Students at Keyham, The Treatment of, 542
Submarine Boat, Some Details of the "Holland," 302, 314, 447
Summary of Papers Read before the Institution of Naval Architects, 66
Summary of Shipbuilding Returns of United Kingdom in 1899, arranged in order of Tonnage Built by each Firm, 448
Swan, Mr. H. F., on Ice Breakers, 194
Taylor's Patent Door Hook and Eye, 538
Temperance in the Navy, 113
Thermoscopic Loop Steam Trap, The, 401
Thornycroft, John I. & Co., 51

Throttle Valve, Patent Automatic, 497
Thrust Bearing, The Mossberg Patent, 291, 492
"Titus Edrigevitch," The Dredger, 84
Tolch & Co., of Fulham, 102, 166, 323, 363
Tonnage Built by each Firm, Summary of Shipbuilding Returns of United Kingdom in 1899, Arranged in order of, 448
Torpedo-boat Building on the Thames, 51
Torpedo-boat Destroyer, 4
Torpedo-boat Destroyers as Queen's Escort, 21
Torpedo-boat Destroyers, The Speed of, 71
Torpedo-boats, The Internal Construction of, 112
Trafalgar Day, 349
Training of the Engine Room Department, The, 111
Transport Service, The, 343, 348, 386, 397, 436
Trap, The Thermoscopic Loop Steam, 401
Trials and Experiments made in H.M.S. "Argonaut," 53, 66
Triple-Expansion Engines of S.S. "Manchester Corporation," 158
Triple-Expansion Engines. Some Interesting Diagrams from, 168
Triple-Expansion Launch Engines, 542
Tube or Pipe-Cutting Machine, The Fox, 383
Tubes, Homacoustic System of Voice, 268
Twin-screw Cable Steamer "Von Podbielski," 480
Union Dry Dock at Limehouse, The New, 222, 263
United States Metallic Packing Co., Limited, 75
United States Navy, Electric Motors in the, 400
United States Navy, The, 114, 216, 301
Value of the Fleet in Regard to the War, The, 444
"Venerable," The Launch of the, 396
"Vengeance," H.M.S., 152
"Vengeance," Launch of H.M.S., 214
Ventilating Fans, 255
Vertical Petroleum Engine, 299
Vessels Launched in 1899, List of, 449
"Victoria and Albert," The Launch of the New, 113, 116, 506
Views on Board the R.M.S. "Arcturus," 77
Vile's Patent Water Gauge, 60
"Viper," The Speed of the, 508
Visit to Elswick, 195
Voice Tubes, Homacoustic System of, 268
"Von Podbielski," Twin-Screw Cable Steamer, 480
"Vril" Electric Launches, 266
Warship Building in the United Kingdom, 73
Warships for Japan, New, 217
Warships for the World, 394
Warships in Collision, 260
Warships, Machinery of, 28, 67
Warships, Stranded, 301
Warships, The Docking of, 72
Water Gauge, Patent, 60
Watertight Bulkhead Door for Ships' Holds, 252
Water-tube Boiler, Cylindrical Marine, 443
Water-tube Boiler, Phillips's, 503
Water-tube Boilers during the Manœuvres, The, 262
Water-tube Boilers, Experiments with, 23
Water-tube Boilers for Marine Engines, 28
Water-tube Boilers in the German Navy, 96
Water-tube v. Scotch Boilers, 217
Watts, Mr. Philip, on Elswick Cruisers, 192
"Waverley," The Clyde Passenger Paddle Steamer, 310
Weighton, Prof. R. L., on Receiver Drop in Multiple-Expansion Engines, 485
Weir's Feed Pumps, 151
Western Australian Coal Prospects, 254
White, Sir W. H., C.B., LL.D., F.R.S., 30
White Star Liner "Oceanic," The, 297
Willis, General, and the "Naval Annual," 262
Wireless Telegraphy, 25, 74, 118, 159, 268, 355, 390, 505, 508, 540
Work Completed During the Year, 464
Work on Hand in British Yards, 464
Work on Hand in Foreign Yards, 465
X.L. Adjustable Lathe Mandrel, The, 69
Yarrow, Mr. A. F., on the Durability of Water-tube Boilers, 195, 201
Yarrow-Schlick-Tweedy System of Balancing of Engines, 17

TRADE NOTES, &c.

Belfast, 37, 86, 128, 167, 230, 278, 324, 364, 412
Clyde and Scotland, 31, 79, 123, 160, 224, 273, 317, 356, 406, 468, 514, 550
Electrical, 25, 74, 118, 159, 220, 267, 314, 354, 400, 447, 504, 548
Liverpool and Birkenhead, 519, 554
Marine Engineers, 24, 76, 117, 154, 218, 264, 305, 354, 398, 441, 498, 545
Mersey, 35, 82, 127, 164, 228, 276, 321, 361, 411, 472, 517, 553
Naval Matters, Past and Prospective, 20, 70, 111, 155, 214, 257, 301, 347, 390, 444, 506, 539
North-West of England, 38, 86, 129, 167, 231, 279, 324, 365, 413, 475, 520, 556
Tees, Hartlepools, &c., 35, 82, 126, 164, 228, 276, 321, 360, 410, 472, 517, 553
Thames, 37, 84, 128, 165, 229, 277, 322, 362, 412, 474, 520, 555
Tyne, 34, 80, 125, 162, 226, 274, 319, 359, 409, 470, 516, 552
Wear, 35, 82, 126, 163, 227, 275, 320, 360, 410, 472, 517, 553

OBITUARY.

Anderson, Sir William, K.C.B., 5
Berthon, Rev. Edward Lyon, 381
Blackburn, Edwin, 232
Caird, David, 87
Colomb, Vice-Admiral Philip Howard, 350
Dees, James, 515, 547
Dietrich, Herr Alfred, 5
Du Santoy, Charles Shenton, 380
Egerton, Commander, 391
Fanet, M. Paul, 16
Faure, M. Felix, 5
Fowler, Sir John, K.C.M.G., 5
Gilchrist, Archibald, 515
Gray, Sir William, 5
Ismay, Thomas H., 402, 441 (with photo.)
Kemp, Dixon, 403
Laird, William, 5
Mackay, Edward, 403
Napier, John, 515
Short, John, 527
Stephen, Alexander, 132
Tindall, W. H., 5
Wilson, A. H., 515

LETTERS TO THE EDITOR.

Brake Horse Power Appliances, 562
China, The P. & O., 46
Coal Endurance, Speeds and, 46
Combustion by means of Hollow Fire-Bars, 280
Composition to Prevent Leakage of Marine Boilers, 527
Forced Draught, A New Method of, 280
"Hero" and "Sasso," The, 280
Japanese Institution of Naval Architects, 527
Japan Mail Steamship Co.'s New Vessel, Trials of the, 527
"Kaiser Friedrich der Grosse," The, 280
New Method of Forced Draught, A, 280
Norddeutscher Lloyd, The, 280
"Oceanic," The, 46
"Oriental" Dry Dock, Shanghai, 325
Receiver Drop in Multiple-Expansion Engines, 562
Schichau, F., And the Hamburg-American Line, 280
Shanghai Engineering, Shipbuilding, and Dry Dock Co., Limited, The, 325
Speeds and Coal Endurance, 46
"Swa-Maru," Trials of the, 527
Wilson Line, The, and Water-tube Boilers, 280

BOOKS REVIEWED.

Almanac for 1900, Reed's Tide Tables and Nautical, 563
Arc Lamps and How to Maintain them, by H. Smithson and E. R. Sharpe, 562
Arithmetic of Electrical Measurements, The, by W. R. P. Hobs, 375
Bells and Alarms, Electric, by F. E. Powell, 562
Boiler Practice, Steam, by Walter B. Snow, S.B., 271
Boilers, Their Priming and General Management, and Notes on Water-tube Boilers, Reed's Marine, by Henry J. Davis, 39
Brassey's Naval Annual, by the Hon. T. A. Brassey, 142
Code Book, The Shipowner's Technical, by Walter Phillips, 376
Diary and Navy Handbook for 1900, The Royal Navy List, 448
Diary and Year-Book for 1899, The Mechanical World Pocket, 179
Dictionary of Electrical Engineering and Chemistry in German, English, and Spanish, A practical, by Paul Heyne, 94
Eight Decades, A Retrospect of, by the Rev. E. L. Berthon, 39
Electrical Engineering and Chemistry in German, English, and Spanish, A practical Dictionary of, by Paul Heyne, 94
Electrical Measurements, The Arithmetic of, by W. R. P. Hobs, 375
Electric Bells and Alarms, by F. E. Powell, 562
Electric Wiring, Fittings, Switches and Lamps, by W. Perren Maycock, M.I.M.E., 563
Engineer's Year-Book of Engineering Formulæ, Rules and Tables for 1899, The, by H. R. Kempe, A.M. Inst. C.E., 39
Engine-Room Practice, by John G. Liversedge, R.N., 94
Engines, Marine, by L. E. Bertin, 563
English and German Naval Word Book, by N. W. Thomas, M.A., 563
Feilden's Magazine for September, 376
How to Enter the Royal Navy, by Ernest J. Felix, 375
Institution of Naval Architects for 1899, Transactions of the, 562
Know your own Ship, by Thomas Walton, 223
Lamps and How to Maintain them, Arc, by H. Smithson and E. R. Sharpe, 562
Lamps, Electric Wiring, Fittings, Switches and, by W. Perren Maycock, M.I.M.E., 563
Machinery of Steamships, by John G. Liversedge, R.N., 94
Magazine, Feilden's, 376
Marine Engineering, Rules and Tables, A Pocket Book of, by A. E. Seaton and H. M. Rounthwaite, M.I.M.E., M.I.N.A., 562
Marine Engines, by L. E. Bertin, 563
Mechanical World Pocket Diary and Year Book for 1899, 179
"Merrimac," The Sinking of the, by Naval Constructor Hobson, U.S.N., 141
Naval Annual, The, by the Hon. T. A. Brassey, 142
Naval Pocket Book, The, Edited by L. G. Carr Laughton, 271
Naval Word Book, The, by N. W. Thomas, M.A., 563
Navy Handbook for 1900, The Royal Navy List, Diary and, 448
Notes on Water-tube Boilers, Reed's Marine Boilers, their Priming and General Management, and, by Henry J. Davis, 39
Ocean Rainfall by Rain Gauge Observations at Sea, by W. G. Black F.R.M.S., 223
Pocket Book of Marine Engineering, Rules and Tables, A, by A. E. Seaton and H. M. Rounthwaite, M.I.M.E., M.I.N.A., 562
Pocket Book, The Naval, Edited by L. G. Carr Laughton, 271
Pocket Diary and Year Book for 1899, The Mechanical World, 179
Practical Dictionary of Electrical Engineering and Chemistry in German, English and Spanish, A, by Paul Heyne, 94
Rain Gauge Observations at Sea, Ocean Rainfall by, by W. G. Black, F.R.M.S., 223
Reed's Marine Boilers, their Priming and General Management, and Notes on Water-tube Boilers, by Henry J. Davis 39
Reed's Tide Tables and Nautical Almanac for 1900, 563
Retrospect of Eight Decades, A, by the Rev. F. L. Berthon, 39
Royal Navy, How to enter the, by Ernest J. Felix, 375
Royal Navy List Diary and Naval Handbook for 1900, The, 448
Scientific and Learned Societies of Great Britain and Ireland, 1899, Year-Book of the, 179
Scotch v. Water-tube Boilers, by Babcock and Wilcox, 141
Shipowners' Technical Code Book, The, by Walter Phillips, 376
Sinking of the "Merrimac," The, by Naval Constructor Hobson, U.S.N., 141
Slide Valve Simply Explained, The, by William J. Tennant, A.M. Inst. M.E., 223
Steam Boiler Practice, by Walter B. Snow, S.B., 271

Transactions of the Institution of Naval Architects for 1899, 562
Water-tube Boilers, by Babcock & Wilcox, 141
Year Book of Engineering Formulæ, Rules and Tables for 1899, The Engineers', by H. R. Kempe, A.M. Inst. C.E., 39
Year Book of the Scientific and Learned Societies of Great Britain and Ireland, 1899, 179

PATENTS, &c.

Board of Trade Examinations. Return of Engineers Reported to have Passed Examinations under the Provisions of the Merchant Shipping Acts of 1854, 48, 96, 122, 180, 240, 288, 336, 380, 424, 482, 529, 566
Recent Applications for Patents Connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, 47, 95, 143, 179, 240, 376, 423, 482, 528, 564

PARAGRAPHS, NOTES, AND NOVELTIES.

"Akebono," Torpedo-boat Destroyer, 87
"Alaska," The, 205
Allan Line, The, 251
Alldays & Onions, Messrs., 315
Alleged Tampering with the Mails, 587
American Electric Crane, 150-ton, 75
American Line, The, 68, 206, 495
American Mails, The, 180, 496
American Steamship Enterprise, 68
Amusing Rumour, An, 342
"Angerton," The, 61
Anti-Attrition Metal, 587
Aspinall Patent Marine Engine Governor, 65
Atlantic Passenger Traffic, 495
Atlantic Transport Company, The, 207
Atmospheric Silent Ash Hoist, 315
Auxiliary Machinery, 25
Auxiliary Steam Power Co., 323
Babcock & Wilcox, 322
Binko, H. & Co, 272
Boiler Feed Pump, 474
Brancker, Mr. John, 487
Bremerhaven, 344
Bristol and its Docks, 344, 387
Broadheath Works of the Linotype Co., The, 159
"Bulgaria," The, 14
Buoyant Clothing Syndicate, Limited, The, 404
Campbeltown, Shipbuilding at, 47
Canadian Coast, The Dangers of the, 344
Canadian Mails, 209
Canadian Steamship Co, The, 15
Canadian Steamship Lines, 252
Canal Boat Haulage, 220
Cantilever Electric Crane, 159
Cape Lines, Limited, The, 438, 495
Cape Mails, The, 16
Cardiff, 209
"Carisbrook Castle," The, 295
Castle Line, The, 110, 294
Castle Union Amalgamation, The, 586
Casualties, Recent, 209
Catalogues, 16, 46, 77, 404
"Cavan," The Barquentine, 16
Change of Name, A, 62
Changes in Shipping and Shipbuilding Concerns, 251
Channel Islands Service, The, 298
"China," P. & O., 15, 110, 150, 205
City of Dublin Steam Packet Co., The, 106, 148, 205
City of London College, 366
"City of Rome," The, 295
Clyde Steamship Owners' Association, 160
Collisions at Sea, Prevention of, 220
Compagnie Generale Transatlantique, The, 108, 148, 208, 385, 437
Companies, New, 208
Cunard Company's Meeting, The, 62
Cunard Company, The, 15
Cunard Engineers, 209
Cunarder, A Reported New, 293
Dangers of Deep-Draught Steamers, The, 292
Deal, A Big, 207, 251
Deighton's Patent Flue and Tube Co., Ltd., The, 404
De Laval Steam Turbine, 555
Denny & Brothers, Messrs., 249
Derelicts, 209
Disaster on the Tugela River, The, 438
Disasters, 15
Dock Extensions, 251
Dominion Line, The, 251, 486
Donald Currie & Co., Messrs., 436
Dredger for Japan, 180
Dry Dock, New, 405
Durban, The Port of, 488
Econalaz & Leith, Messrs., 74
Edwards' Air Pump Syndicate, Ltd., The, 115
Elder, Dempster & Co., Messrs., 16, 107, 251, 438
Elder, Dempster Lines, The, 535
Electrical Canal Haulage, 557
Electrical Installation of the "Oceanic," The, 548
Electrically Driven Barge, 267
Electrically Propelled Ferry-boats, 267
Electrical Measurement of the Oscillation of Ships, 314
Electrical Motors on Board Ship, 547
Electrical Power for Marine Propulsion, 504
Electrical Refrigerator, 268
Electrical Siren, 314
Electrical Ventilating Fan, 159
Electric Blackman Fan, 47
Electric Cranes, 220
Electric Lamp, A New Possible, 505
Electric Power in Engineering Shops, 505
Electric Power in Engineering Works, 355
Electric Pumps for Canals, 159
Electric Traction on the Erie Canal, 504
Electro-Plating the Hulls of Vessels, 75
Engineering Work in Middlesbrough, A Smart piece of, 239
Engineers of the S.S. "Kennett," The, 252
Error, A Curious, 15
Evoy Patent Adjustable Compass, The, 537
Famous Greyhound, A, 110
Fanet, M. Paul, 16
Ferry-boat Run by Storage Batteries, 447
Financing of Steamship Companies, The, 16
Firth, Thomas & Sons, Ltd., 46
Fleming, Birkly & Goodall, Ltd., 46
French Atlantic Trade, The, 68
Frodingham Iron and Steel Company, The, 547
"Fulda," The, 107
"Gallia," The Accident to the, 148, 436, 536
"Gaspesia," The, 62, 209, 252, 298, 342, 437
Geipel & Lange, Messrs., 527
German Steamship Companies, The, 437
Glow-Lamp Explosions, 505
"Gorsedd," The, 250
Gourlay Bros. & Co., Messrs., 410
Governor for Marine Steam Engines, 25
Great Eastern Railway Company, The, 107
Griffin Launch Engine, 474
Hall, J. & E., Limited, 363
Hamburg-American Line, The, 207, 293, 386, 496
Harland & Wolff, Messrs., 15
Hartmann's Rahtjens Improved Composition, 77, 249, 298, 366
Helicoid Locknut Patents (Parent) Co., Ltd., The, 268
Hopkinson, John, Memorial, 557
Howden, James & Co., 497
"Inadsuma," The, 210
India Rubber, 290
Influence of Cheap Fuel on the Cost of Electrical Energy, 504
Institute of Marine Engineers, 376
Institution of Junior Engineers, 240
Institution of Naval Architects, 147, 239, 547
In War, In Peace, 342
Iron and Steel Institute, 30
Ironclads fitted with Yarrow Boilers, 414
Isle of Man Competition, The, 208
Isle of Man Steam Packet Company, The, 497
Ismay, Imrie & Co., Messrs., 149
Ismay, Mr., 208, 344
"Ivernia," The New Cunarder, 295
Jamaica Produce and Fruit Co, Ltd., 295
Japanese Institution of Naval Architects, 257
Japanese Launches, 557
Johnson & Phillips, 547
"Kaiser Friedrich," The, 252
"Kaiser Wilhelm der Grosse," The, 293, 386
Kellock, Messrs C. W. & Co., 16, 62, 497, 535
Kelvin, Lord, 149
"Kildonan Castle," The, 294
"La Bourgogne, 148, 207
"La Lorraine," 294
Lane Routes, 147
Le Repertoire Generale de la Marine Marchande, 344
Leyland Line, The, 108
Liquid Fuel, 494
Liverpool, 107
Liverpool Dock, The New, 182
London Brighton & South Coast Railway, The, 537
Lowestoft Low Lighthouse, 182
Magnetic Clutch, A, 548
Magnolia Anti-friction Metal Co., and Others v. Sugden and Others, 122
Man as a Heat Engine, The Efficiency of, 210
Manhattan Refrigerating Co.'s Plant, 220
Marconi's Visit to the United States, 504
Marine Engineers' Examinations, 50, 60, 65, 189, 217, 218, 346, 380, 503
Maudslay and Field, 323
Maxim Direct Coupled Generator Set, 159
Maxim Incandescent Lamp, The, 220
"May Flint," The, 536
Melhuish, Richard, Sons & Co., 16
Menzies, Messrs., 438
"Merrimac," The, 487, 495
Mersey Docks and Harbour Board, The, 344
"Meteoro," The, 494
"Milwaukee," The, 64
Missing Steamers, 14
Missions to Seamen, The, 336
"Moravia," The, 14
Nederland-American Company, The, 16
Nernst Electric Lamp, The, 159, 220
Niji, The, 538
Norddeutscher Lloyd, The, 207, 252, 293, 493, 537
Norddeutscher Lloyd, Annual Report of the, 64
Nova Scotia Steel Company, The, 410
Nunn, Ridsdale & Co., 232
"Oceanic," The New, 148, 207, 295, 387
Palermo, 380
P. & O. Company, The, 16, 148, 488
"Paris," The, 149, 208, 250, 437, 494

"Patria," The, 537
"Pavonia," The, 14, 63
Pictorial Post Cards, 253
Pilot Sued, A, 148
Pimbley Patent Forced Circulation Economiser, 278
Power by the Tides, 268
Promotion of Mr. Walter J. Howell, 106
Rankine Patent Feed-water Filter Company, Ltd., The, 401
Recent Heavy Losses in Missing Steamers, A result of the, 62
Removal, Notice of, 380, 439
Richardson, T. & Sons, Limited, Messrs, 336
Russian Volunteer Fleet, The, 148
Scotch Steel Makers, 412
Seaside Service, A New, 149
"Shamrock," Dimensions of the, 323
Shaw, Savill and Albion Company, The, 107
"Sheldrake," Trials of H.M.S., 322
Shipbuilding Amalgamation, A, 150
Shipbuilding at Cambeltown, 47
Shipbuilding Companies, 387
S. Lawrence, Trade, The, 61
Smart Passage of Clyde-built Dredgers, 421
Southampton, 208, 251
Southampton *v.* Liverpool, 207
South Eastern and London Chatham & Dover Railways, The, 15
Southgate Engineering Company, 77
Southwold, The Exploitation of, 295
Space Telegraphy, 447
Steam and Hydraulic Packing, 239
Steamers, Missing, 14
Steam Syrens, 153
"Stella," The, 62, 108, 207
Stephenson, Robert & Co., Ltd., 239
Stern Brothers, Messrs., 180
Strandings, 108, 148
Submarine Telegraphy in the Navy, 355
Surface Condensing Plants, 25
Swansea Dry Dock, The New, 144
Sydney Vancouver Services, The, 107
"Tainui," The, 386
"Tarifa," The, 61
Test of Electric Driven Fans, 268
Thacker, W. & Co., Messrs., 253
Thames, The Condition of the River, 343, 385
Thompson Brothers, 328
Thornycroft, John I. & Co., 363
Three in one oil, 232
"Times" and the Transports, The, 536
Towing Barges at Sea, 536
Transport Service, The, 343, 348, 386, 397, 436, 496, 537
Trinity House and Wireless Telegraphy, 548
Turner Brothers, Limited, Messrs., 442
Ventilation of Ships, 47
Volta, 220
"Waikato," Remarkable Voyage of the, 385
Wailes, Dove & Co., 47
War in South Africa, The, 496
Washington Experimental Tank, 314
Water Automobile, A, 268
West India and Pacific Steamship Co., The, 63
West India Mail Contract, The, 251
Westinghouse Electric Co., 220
White Star Line, The, 63, 250, 437, 497
Whitworth Scholarships, 266
Wireless Telegraphy, 25, 74, 118, 159, 268, 355, 390, 505, 508
Wireless Telegraphy, 314
Wood & Newland, Messrs., 240
"Wydales" Cargo on Fire, 414

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.

Abbey Holme, 134
Achaque, 91
Achecolands, 281
Active, 331
Adalia, 134
Adato, 370
Adrian, 522
Adriana, 477
Adriatico, 419
Advice, 371
Aero, 421
Agamemnon, 559
Aira, 330
Airedale, 40
Akranes, 40
Alabama, 137, 301
Albatross, 134
Albert, 113, 116
Alcinous, 478
Algarve, 174
Algoma, 88
Algorea, 233
Alma, 373
Alpha, 329
Alpha, 523
Amadavat, 175
Amazonense, 136
Ambassador, 237
Amesbury Abbey, 476
Anaxo, 43
Andes, 88
Andrei Stempinsky, 330
Andromeda, 367
Angele, 91
Anglia, 523
Anglo-Australian, 88
Aqua, 523
Arcadia, 133
Arechomdo, 328
Archanda, 89
Argyll, 523
Aries, 42
Arnage, 326
Asahi, 43
Assaye, 371
Assumburg, 40
Assurance, H M S., 479
Atbara, 284
Atlanta, 330
Atlantian, 233
Atlas, 522
Atlas, 558
Auchenarden, 174
August Lefler, 476
Aurora, 42
Avondale, 282
Axinite, 330
Balakani, 282
Bali, 236
Balmoral Castle, 136
Banca, 558
Banderas, 172
Barendsz, 368
Baron Eldon, 282
Barrow Castle, 138
Barton, 133
Bath City, 233
Battenhall, 476
Bavarian, 137
Beatrice, 88
Beaver, 41
Begonia, 416
Bellona, 478
Belvoir Castle, 42
Ben Attow, 560
Ben More, 175
Ben Venue, 175
Bernicia, 281
Beta, 170
Birker Force, 43
Blanche, 284
Bloomfield, 328
Boadicea, 40
Border Knight, 175
Bornu, 135
Bostonian, 558
Bothnia, 332
Braeside, 523
Brenda, 416
Briardale, 559
Brimsnes, 134
Brinkburn, 135
Bristol City, 326
Britannia, 133
British Prince, 415
British Princess, 235
Britomart, H.M S., 88
Brough, 419
Brunswick, 415
Bulwark, 349
Burton Port, 92
Bylands, 328
Cambrian, 558
Cairness, 331
Caisson, 284
Caledonia I., 421
Calchas, 137
Canganian, 479
Caprice, 134
Carmel, 91
Cassandra, 171
Castro, 89
Caucasian, 415
Cecil Rhodes, 417
Cedric, 134
Celtic, 136
Celtic Princess, 144
Champion, 282
Charles Achaque, 91
Charlotte, 559
Chester, 523
Chieftain, 170
Chieftain, 237
Chumleigh, 522
Cito, 281
Citrine, 478
City of Aberdeen, 136
City of Carlisle, 43
City of Manchester, 476
Clan Alpine, 367
Clan Colquhoun, 41
Clan Farquhar, 233
Clan Macaulay, 43
Clan Macfadyen, 284
Clan Mackay, 43
Clan Maclachlan 560
Clan Maclaren, 92
Clan Urquhart, 283
Claudius, 42
Claughton, 174
Claverdon, 331
Cleopatra, 88
Clinton, 41
Clonallon, 371
Clumberhall, 328
Clyde, 525
Commander, 175
Commander Lawley, 281
Connie, 558
Conqueror, 133
Cork, 92
Cracker, 478
Cragoswald, 137
Craigellachie, 173
Cressy, 446
Crewe, 135
Croham, 419
Crown Point, 522
Cruden Bay, 284
Custodian, 525
Cuzco, 372
Cymodocee, 558
Dacia, 415
Dale, 370
Daphne, 417
Darleydale, 283
Dartmeet, 89
Defender, 90
Denbighshire, 367
Devolant, 407, 421
Diana, 90
Domingo de Larrinaga, 173
Don Hugo, 330
Donside, 419
Doon, 331
Dorothy, 367
Drachenfels, 416
Dreadnought, 90
Drumbain, 235
Drumblade, 560
Drumblair, 420
Duchess of Fife, 139
Duchess, The, 370
Duke of Rothesay, 175
Duncan, 523
Dundalk, 189
Dunlossit, 479
Eclipse, 331
Edith, 420
Eduard Bary, 417
Eemstroom, 174
Eider, 42
Elantsobe, 42
Elba, 139
Elfleda, 281
Elgin, 42
Elsie, 171
Elswick Park, 173
Emily, 134
Emulator, 136
Engineer, 478
Enidwen, 171
Equator, 136
Era, 42
Ern, 560
Erne, 136
Eros, 368
Esles, 560
Ethel, 281
Ethelinda, 419
Etruria, 369
Eva, 417
Everingham, 369
Exmouth, 367
Falaise, 89
Fantee, 43
Federica, 332
Fenmount, 523
Ferndene, 234
Finanzminister Witte, 285
Finnieston, 421
Fleswick, 479
Florence, 525
Floriken, 172
Floristan, 170
Formby, 171
Fred, 40
Freiburg, 417
Fulmar, 40
Gadsby, 88
Gadsby, 369
Galeka, 421
Garonne, 172
G. A Savage, 525
Gilderoy, 40
Gipsy, 327
Gladys, 560
Gleniffer, 174
Glenroy, 282
Glory, 22, 26
Glynn, 371
Golden Eagle, 175
Goldseeker, 479
Gorbea, 42
Gottfried, 133
Granada, 327
Granit, 175
Gresham 419
Grosmont, 233
Guatemala, 137
Gwynwood, 40
Gymeric, 42
Hanna, M.A., 94
Hannover, 283
Harburg, 237
Harriet, 367
Hawkwood, 415
Heemskerk, 370
Helen, 479
Helsingborg, 416
Hercules, 476
Hermes, 43
Hero, 283
Heros, 419

Hesperides, 415
Hibernia, 371
Highgate, 88
Hillbrook, 281
Hillglen, 327
Hirundo, 367
H.M.S. Assurance, 479
H.M.S. Viper, 326
Holmgarth, 170
Hope, 421
Horatia, 478
Hornby Castle, 370
Hornsea, 416
Hortensius, 90
Huddersfield, 477
Hugin, 171
Humber, 419
Hyades, 170
Hydra, 235
Hyles, 332
Hyson, 371
Idzumo, 326
Implacable, 22
Inchkeith, 185
Ikadsuchi, 4
India, 134
Indradevi, 522
Ino, 331
Insizwa, 286
Invernia, 560
Irene, 91
Irishman, 136
Isel Holme, 326
Isernia, 135
Isis, 134
Islanda, 368
Ismore, 92
Itaura, 421
Itzehoe, 332
Ivernia, 295, 328
Jabiru, 41
Japura, 331
Jed, 285
Jerid, 281
John H. Barry, 416
Jokai, 89
Jupiter, 560
Jurua, 419
Jurupary, 478
Kaffir, 371
Karamea, 288
Kathleen, 88
Kathleen, 558
Kelvingrove, 174
Kennet, 285
Kensington, 559
Kent 41
[illegible], 524
Khartoum [illegible]
Kielder Castle, [illegible]
Kilbroney, 560
Kildonan Castle 285
Kilnsea 415
Kinfauns Castle, 128, 188
King Alfred, 88
King Edgar, 326
King Erik, 89
King Haakon, 558
King Harold, 40
King William, 558
Kittiwake, 235
Knowsie, 175
Kokine, 358, 372
Korea, 373, 507
Kumara, 134
Lake Erie, 420
Lakeside, 524
Lakonia, 186
Ledokol III., 282
Leven, 370
Lincolnshire, 91
Lindsey, 416
Linnet, 477
Livingstone, 558
Lizzie, 559
Llanoner, 416
Loch Linthrathen, 88
Lockwood, 522
Loire, 368
London Bridge, 477
Lord Downshire, 418, 421
Lord Erne, 524
Lord Ormonde, 234
Lucifer, 282
Luciline, 170
Lucy, 91
Lucy, 478
Lune, 420
Lutra, 284
Lydie, 326
Lynton, 282
Mabel Grace, 40
Macedonia, 417
Machaon, 236
Magnific, 90
M. A. Hanna, 94
Maidstone, 44
Mambare, 479
Manchester Commerce, 283
Manchester Corporation 172
Manchester Importer, 171
Manchester Merchant, 476
Manchester Port, 133
Manchester Shipper, 418
Manu, 183
Marburg, 558
Marchioness, 330
Margaret, 476
Mariposa, 369
Maristow, 281
Marwarri, 479
Mary, The, 40
Mavisbrook, 283
May, 43
Memsie, 236
Mentor, 367
Mercury, 560
Mersey, 370
Milton, 89
Milwaukee, 90
Minerva, 558
Mingary, 174
Minneapolis, 413
Minto, 237
Molopo, 477
Montauk Point, 327
Mont Blanc, 88
Montenegro, 559
Montezuma, 286
Mountswald, 525
Mora, 415
Naudu, 170
Nedenaes, 327
Nelson, 40
Neptune, 90
Neptuno, 174
Newholm, 42
Newington, 41
Newport News, 43
Newton Hall, 285
Nickolaeiff, 175
Nidd, 370
Niels Ebbensen, 380
Nina, 522
Nordpol, 185
Norfolk, 477
Northlands, 476
North Sea, 234
Northwood Ho, 133
Novington, 89
Noyra, 173
Numimu, 90
Nuttallia, 281
[illegible], 174
Oceanic, 41
Ohio, 135
Olanda, 284
Oliver Cromwell, 476
Onward, 41
Oro, 370
Oriflamme 133
Ormley, 172
Orna, 236
Ortona, 231, 234
Osmo, 559
Otta, 136
Panaghi Vagliano, 368
Pandora, 510
Papaioa, 286
Paragon, 43
Parana, 138
Paris, 137
Parkside, 479
Peareth, 41
Pearl, 281
Pearl, 327
Pena Castillo, 372
Pena Sagra, 478
Penguin, 330
Penrith Castle, 418
Pera, 285
Persian Empire, 326
Persic, 332
Pervi, 188
Peter Hamre, 525
Petunia, 234
Ping Suey, 93
Pioneer, 214
Planet Venus, 560
Pomona, 90
Portadown, 560
Portugal, 171
Poulton, 44
Prestonian, 236
Progress, 330
Protector, 282
Providence, 329
Puffin, 419
Puritan, 559
Pydna, 524
Quarnero, 420
Quassia, 368
Raithmoor, 40
Rajah, 40
Rajah, 236
Ranee, 332
Ranee, 558
Rapid, 421
Rathlin Head, 372
Ravenscraig, 419
Rembrandt, 91
Renown, 91
Rhodesia, 41
River Fisher, 287
Riverside, 479
Riverton, 235
Robert Irvine, 281
Robina, 415
Rokeby, 284
Rollo, 234
Rosalie, 476
Rosario, 559
Rostrevor, 330
Rourik, 478
Rowena, 173
Ruby, 368
Runo, 369
Saint Kevin, 524
Salamis, 92
Saldanha da Gama, 137
Sambia, 525
Sandsend, 369
Saugara, 89
San Salvador, 136
Sappho, 560
Sardinero, 371
Sardius, 367
Saturn, 560
Sazoline, 327
Saxon, 525
Saxonia, 139
Saxonia, 479
Saxon Prince, 135
Scandinavia, 44
Schwarzenfels, 477
Scotsman, 88
Seabreeze, 284
Seagull, 173
Seagull, 372
Seapoint, 90
Seaton, 281
Sebriana, 370
Secunda, 44
Seine, 41
Setter, 478
Sevilla, 559
Shamrock, 370
Shandon, 186
Sheppy Allison, 328
Shieldrake, 326
Shinano Maru, [illegible]
Shirley, 477
Shunkai Maru No. 1, 524
Sicilian, 332
Silvio, 189
Sirdar, 40
Sirdar, 174
Sirius, 560
Skandia, 416
Skipsea, 558
Sokoto, 40
Somerford, 233
Sophron, 183
South Australia, 175
Southgate, 415
Sparta, 235
Sparton Chief, 236
Speedwell, 419
Spero, 368
Standard, 134
St. Anthony, 90
Star of Australia, 234
Stat, 136
St. Bede, 40
St. Blaize, 330
St. Dunstan, 476
St. George, 415
St. Gothard, 416
Stirling Castle, 371
St. Lawrence, 368
Strathbraan, 420
Strathmore, 420
Strombus, 418
Stryon, 327
Suffolk, 281
Sunningdale, 326
Surrey, 173
Sussex, 528
Swallow, 367
Swallow, 477
Swan, 368
Swindon, 172
Syriam, 330
Tagus, 236
Tanagra, 284
Tantallon Castle, 137
Taymouth, 138
Tayside, 174
Telefon, 522
Tento, 330
Teodoro de Larrinaga, 173
Terek, 144
Teresa, 478
Texas, 44
The Duchess, 370
The Mary, 40
Thistle, 175
Thomas Leigh, 415
Thordis, 89
Tilia, 524
Titania, 479
Toward, 332
Toxteth, 135
Trent, 331
Tressillian, 282
Travessa, 326
Triton, 174
Tugela, 560
Tullochmoor, 188
Tunisian, 524
Tupa, 479
Tyrie, 286
Ulapool, 307
Una, 330
Undaunted, 133
Undine, 175
Upada, 91
Upnor, H.M.S., 91
Urlana, 330
Val de Travers, 479
Valetta, 43
Vampire, 282
Vauxhall, 523
Venerable, 396
Venetia, 327
Vengeance, 214, 231,
Ventmoor, 559
Venture, 139
Verona, 329
Verulam, 233
Victoria, 118, 116,
Vienna, 173
Viking, 89
Vinolia, 283
Vladimir, 479
Volcano, 332
Von Podbielski, 419
Vtoroi, 173
Wallsend, 175
Wamba, 172
Wandby, 40
Warfield, 43
Warwick, 90
Waterloo, 415
Waverley, 174
Wearside, 329
Weissenfels, 134
Wellington, 135
West Point, 88
Whakatane, 415
Wilcannia, 175
Winchester, 236
Winifredian, 44
Winkfield, 478
Yomoana, 88
Zealandia, 91
Zeeburg, 476
Zeila, 559
Zillah, 559
Zinnia, 523
Ziska, 92

VESSELS NOT NAMED.

Dredger, 90
Hopper Barge, 175
Paddle Steamer, 327
Screw Steamer, 175
Steam Dredger, 558
Steam Launch, 233
Steam Trawlers, 282
Steel Barge, 283
Steel Lighter, 139
Steel Screw Steamers, 136, 281, 415, 419
Twin Screw Steamers, 41, 419

TRIAL TRIPS.

Active, 422
Aero, 526
Airedale, 139
Akebona, 140
Akebona, 330
Alderney, 334
Alma, 422
Amphitrite, 73

Anglo-Australian, 141
Anna, 46
Anversville, 140
Aqua, 562
Arcadia, 179
Archanda, 140
Archondo, 380
Assurance, H.M.S., 561
Atlantian, 375
Auchenarden, 238
Avondale, 384
Balakani, 334
Bali, 422
Bardistan, 45
Bardsey, 45
Barendis, 422
Barton, 141
Bavarian, 288
Beta, 287
Bethania, 93
Bernicia 384
Birker Force, 94
Blanche, 333
Bloomfield, 422
Braeside, 562
Brier, 286
Brisgavia, 177
British Prince, 481
British Princess, 335
Bylands, 375
Canopus, 262
Capri, 526
Cardiganshire, 44
Cassandra, 238
Caucasian, 526
Celderland, 527
Clan Macaulay, 93
Clan Macfadyen, 335
Claudius, 94
Claverdale, 44
Clumberhall, 422
Commander Cawley, 335
Cork, 178
Crewe, 178
Daphne, 526
Darleydale, 374
Degama, 45
Denbighshire, 423
Derwen, 45
Don Hugo, 480
Dordrecht, 526
Drachenfels, 526
Duke of Rothesay, 287
Duke of Rothesay, 374
Dundalk, 287
Eastham, 288
Eastern, 94
Eclipse, 375
Eduard Bary, 481
Elantsobe, 141
Elba, 289
Elswick Park, 287
Empress, 373
Engineer, 526
Enidwen, 288
Etruria, 423
Everingham, 481
Ferndene, 335
Feronia, 45
Finanzminister Witte, 373
Flora, 176
Floris[illegible], 237
Forth, [illegible]
Gadsby, 4[illegible]
Galeka., 526
Garonne, 287
Gelderland, 561
Gertrud, 45
Gipsy, 177
Glencoe, 481
Glenroy, 374
Golden Eagle, 239
Gothland, 178
Granada. 526
Granit, 289
Greta, 287
Grosmont, 286
Gwynwood, 93
Hannover, 480
Harburg, 286
Harriet, 423
Heemskerk, 481
Helsingborg, 526
Hercules, 561
Hermes, 157
Hero, 374
Hesperides, 481
Hillglen, 422
Hirunda, 422
H.M.S. Kestrel, 46
Hope, 481
Hugin, 286
Humber, 481
Hyanthes 94
Hydra, 333
Hylas, 423
Hyson, 480
Imperial Prince, 288
Inchkeith, 238
Inchmaree, 44
India, 238
Ino, 423
Insizwa, 422
Irishman. 141
Itzehoe, 373
Jabiru, 93
Java, 140
John Coverdale, 140
Jokai, 286
Kathleen, 176
Katso, 422
Kelvingrove, 374
Kestrel, H.M.S., 46
Kilnsea. 481
Korea, 481
Kumara, 287
Kum Sang, 45
Lakonia, 178
Loch Lintrathen, 140
Lockwood, 561
London Bridge, 527
Lord Ormonde, 287
Lucifer, 335
Luciline, 289
Ludvig Peyron, 46
Lynton, 335
Mabel Grace, 334
Macedonia, 526
Manchester Commerce 482
Manchester Corporation, 373
Manchester Importer, 333
Manchester Port, 178
Maristow, 333
Mavisbrook, 286
Medic, 230
Mingary, 287
Minto, 333
Mont Blanc, 177
Montezuma, 335
Montfort, 139
Mo[illegible]bool, 93
Mora, [illegible]
Mundaka, [illegible]
Muristan, 46
Nedenes, 374
Neto, 335
Newcastle, 45
Newholm, 140
Newton Hall, 378
Nicoln Pallibin, 375
Nina, 561
Nordpol, 287
Norham Castle, 422
Northlands. 526
North Sea, 334
Nubia, 561
Ocean, 262
Olanda, 373
Oriflamme. 178
Ormby, 287
Oro, 521
Otta, 178
Parana, 287
Paris, 176
Pauline, 93
Peareth, 93
Pendeen, 44
Penmount, 561
Philippeville, 334
Ping Suey, 179
Portugal, 374
Prometheus, 216
Raithwaite, 45
Rapid, 526
Ras Mora, 177
Ravenscraig, 423
Ravenshoe, 140
Rembrandt, 140
Rhodesia, 94
Riverton, 334
Robert Irvine, 335
Rokeby, 373
Rosalie, 527
Rowena, 334
Saint Andrew, 93
Saint Kilda, 45
Sambia, 561
Sandsend, 480
Sardinero, 422
Saxoline, 375
Saxonia, 177
Saxon Prince, 286
Scandinavia, 176
Seapoint, 139
Sebriana, 481
Secunda, 139
Sheppy Allison, 375
Shieldrake, 373
Shirley, 561
Silesia, 45
Sirdar, 238
Solo, 45
Somerford, 287
South Australia, 288
Southwood, 423
Spero, 423
Spithead, 45
Stanleyville, 481
Star of Australia, 334
Stentor, 176
Stirling Castle, 374
Strombus, 526
Syrian, 407, 423
Tagus, 374
Tanagra, 334
Tanaros, [illegible]
Tantallon Castle, 140
Telefon, 561
T[illegible]dora de Larrinaga [illegible]
Terek, [illegible]
Titan, 141
Trent, 561
Trevessa, 375
Tullochmoor, 177
Una, 177
Una, 334
Undine, 289
Upsda, 179
Upnor, H.M.S., 177
Upnor, H.M.S., 287
Urlana, 374
Val de Travers, 561
Valetta, 140
Verona, 526
Vienna, 287
Volund, 287
Wandby, 93
Warwick, 141
Waverley, 288
Wearside, 422
Weissenfels, 177
West Point, 178
Windsor Castle, 93
Winifredian, 230, 288
Woodford, 44

VESSELS NOT NAMED.
Dredgers, 336
Steam Launches, 286,561

Printed for the Proprietors by PERRY, GARDNER & Co, Foresters' Hall Place, Clerkenwell Road, London, in the County of Middlesex, and Published at the Offices, 3, Amen Corner, Paternoster Row, in the Parish of Christ Church, in the City of London.—March 1st, 1900.

The Marine Engineer.

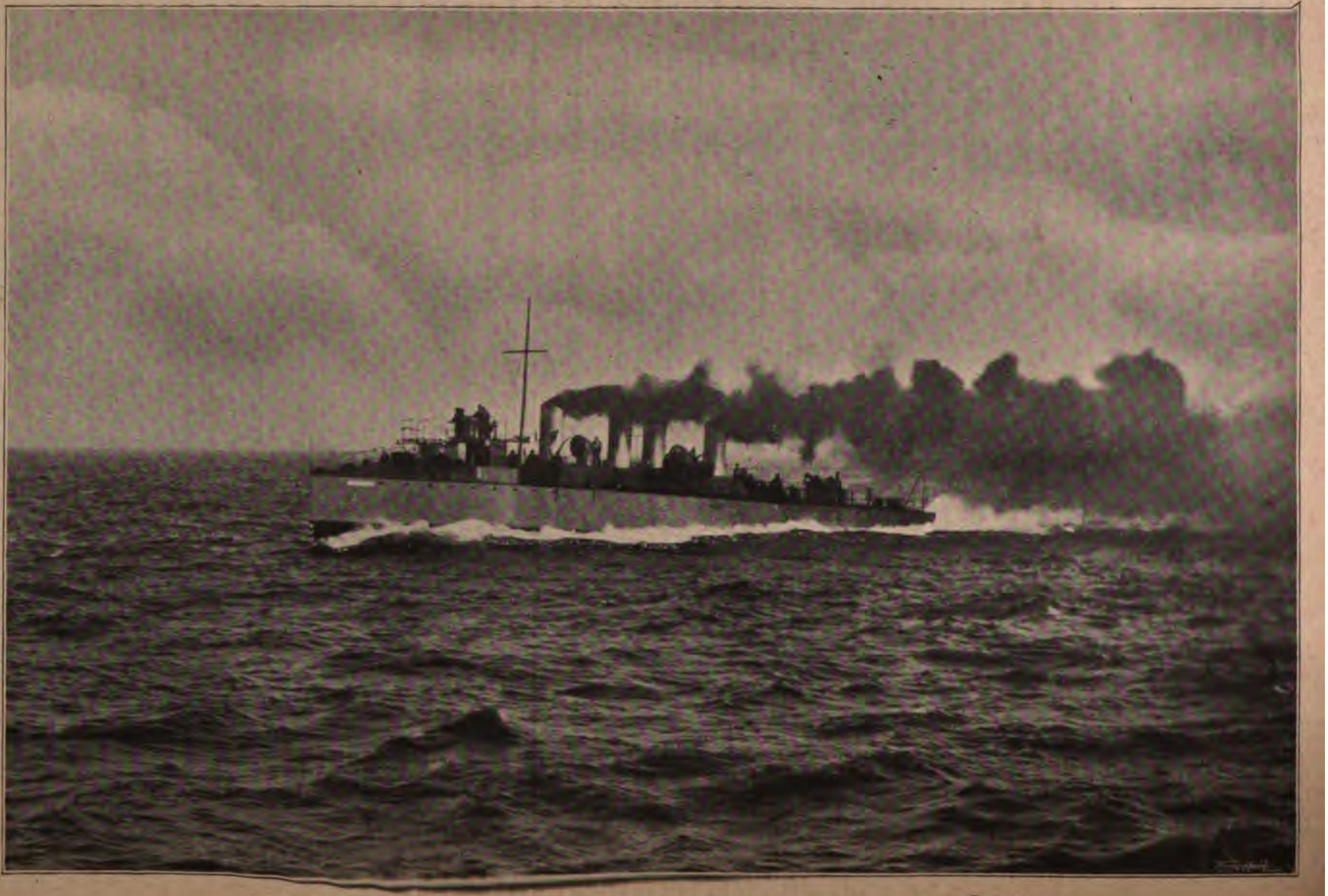
LONDON, APRIL 1, 1899.

THE United States have at last made a decided move to place the Engineer Corps of the Navy upon a proper footing as regards the service officers in the form of a Bill prepared by the Naval Committee and presented to the House of Representatives. This Bill goes to the whole root of the matter, as to relative equality, by an actual amalgamation of what they call officers of the line, or as we should term them executive officers, and the engineer corps of the Navy. In the *North American Review* of December, 1898, the Hon. Francis Wilson, late member of the Naval Committee; the Hon. Theodore Roosevelt, late assistant secretary of the Navy; Commodore John W. Philip, U.S.N.; Commodore George W. Melville, engineer-in-chief U.S.N.; and the Hon George Edmund Ross, chairman of the sub-committee on *personnel* of the Navy, give their personal views of the proposed Bill, and in all cases in favour of it. The amalgamation of all naval officers on board a battleship is a startling solution of the problem, as it implies that all naval officers must be trained to take efficient charge in the engine-room, whilst all engineer officers are to be equally competent at need to take command on the bridge, and have equal executive control over the discipline of the men under them as the other executive officers.

The arguments advanced for this solution are very strong and well worth attention. The Hon. Roosevelt states that "every officer on a modern war vessel in reality has to be an engineer whether he wants to or not. Everything on such a vessel goes by machinery, and every officer, whether dealing with the turrets or the engine-room, has to do engineers' work. There is no longer any reason for having a separate body of engineers responsible for only a part of the machinery. What we want is one homogeneous body, all of whose members are trained for the efficient performance of the duties of the modern line officer. In making this change we are not making a revolution; we are merely recognizing and giving shape to an evolution which has come slowly, but surely and naturally; and we propose to reorganize the Navy along the lines indicated by the course of the evolution itself." The work of the Department in detailing officers for duty will be vastly simpler under the new scheme than it has been in the past, because every officer of the new line will be capable of performing any of the duties which involve the management of large bodies of men or the control of machinery. The *personnel* thus becomes much more elastic, and an end is put to an enormous amount of petty bickering inevitable under the present system. It is believed in the U.S. that this new amalgamation of services will give a navy whose *personnel* has an efficiency far ahead of that of any other country. The Bill also provides for compulsory retirement at a certain age or seniority, so that officers may be advanced to responsible commands within the age of best efficiency. Also warrant rank is to be given to the best mechanicians as an encouragement to the rank and file of the engineer's force. Commodore Melville points out the evolution that has been going on for years in the character and material of the Navy wrought by a single agency, steam, whilst the *personnel* in its fundamental distinctions and classifications has only been half-heartedly following such evolution. On the fighting ship, the fighting man must stand supreme; but he must know how to handle his tools and must change as his ship changes, so that, precisely as he once knew about sails, now he must know about engines. In former days the sea soldier who had once commanded his troops afloat, soon had to become also a sailor man, so now the service officer and the engineer must become one. In short it is absolutely essential that the best naval officer of the future shall be proficient in engineering. Where engineer officers now control from 25 per cent. to 50 per cent. of the crew it is absurd not to rank them equally with other officers as executive and fighting officers. In the sixteenth century, war vessels carried 50 per cent. of their force as soldiers pure and simple. Masters and their mates long existed as a distinct department for the navigation of the vessel. Force of circumstances has gradually caused the absorption of all distinct departments of navigation, gunnery and fighting in the executive of the fleet, marines being now but a fragmentary relic of what was once the original fighting force on board ship; now the evolution is extending to the absorption by the general executive officers of the necessary knowledge in mechanics and engineering. In the U.S. this amalgamation will be fairly easily carried out, as the naval cadets at present, whether for the Line or for the Engineering Corps, follow the same training for three years of their curriculum; and line officers have, in passing for promotion, to undergo an elementary examination in engineering. This thorough and manly mode in the U.S. of recognizing the evolution of the needs of the modern iron-clad Navy is well worth the consideration of our Admiralty and Government. The importance and value to a modern fighting vessel of the engineers, officers, and men can no longer be ignored, and it may be easier and more agreeable to the *amour propre* of the older executive service to themselves become engineers, and thus to absorb what they can no longer ignore, rather than to apparently concede executive power and rank to those they have so long considered non-combatants, and therefore subordinates. In one way or another the amalgamation of the different branches of the service must be effected soon in the British Navy, either by the levelling up of the lower to the higher, or by the absorption of the smaller by the greater. In either case it will not be long before an engineer stands on the bridge and has the full executive control of that position.

Some steam trials of Danish ships communicated by Captain A. Rasmussen, of the Engineering Department of the Royal Danish Navy, to the Institution of Naval Architects, contains some valuable information as to the actual performance under varying conditions, and best conditions of efficiency under some of these conditions, of a torpedo-boat 145 ft. 6 in. in length and of 140 tons' displacement. The particulars investigated may be divided into six heads, viz. :—1st, determination of the maximum speed, the full-power speed for a continued three-hours' run, and the sea speed at normal draught and at a standard depth of water for a trial of at least 12 hours' duration; 2nd, speed trials for the determination of the curves of H.P. and revolutions at normal draught and at different depths of water; 3rd, speed trials for the determination of the above-named curves at the standard depth of water and at different displacements; 4th, coal-consumption trials for the determination of the most economical use of the propelling machinery with different numbers of boilers and engines in use; 5th, trials for determining the time necessary for raising steam and getting under way; 6th, determination of the power of the propeller to decrease and increase the speed of the vessel. It is obvious that when all these facts have been ascertained about any vessel, and we understand 80 double runs on the measured mile were made to determine the curves and 1,800 indicator diagrams taken on the trial, there is not much else worth knowing about such vessel. The records of such exhaustive trials for leading types in our own navy would place in the hands of our commanders such knowledge, under the advice of the engineer-in-chief, as would enable such commander to get the most out of his vessel under any circumstances. In the case in point, given by Captain Rasmussen, the torpedo-boat *Söbjörnen*, whilst giving a maximum speed in two consecutive runs over the measured mile of 23·6 knots, fell to 23·3 knots on a three-hours' full-power trial, and to 18·9 as a sea-speed of at least 12 hours' duration, with necessary fire-cleaning. Under test No. 2 the effects of varying depths of water produced strange effects upon the speed of the boat. At half-power the loss of speed in shallow water is very great, dropping from 18·6 knots in 20 fathoms to 13·1 knots with the same power in 2½ fathoms. At full speed, however, the reverse is the case, full speed of 23·6 knots in 20 fathoms rising to 24·1 knots in 2½ fathoms, and falling to its worst of 22·8 knots in eight fathoms. This would be important to a commander endeavouring to escape an enemy. At top speed seek the shallowest water, and beware of eight fathoms with a draught such as that of this torpedo-boat. Under trial three it was found that the deeper the immersion the greater the H.P., which can be developed with constant cut-off; but the corresponding H.P.'s are higher, the greater the displacement, and with constant H.P. the speed is less as the displacement increases, which is what might be expected. Under test four, for coal-consumption, this may be divided into the constant consumption due to radiation from engines, pipes, boilers, &c., loss by ashes, and by some auxiliary engines, and the effective consumption for speed. The constant consumption is approximately proportional to grate-area, and the effective consumption directly proportional to I.H.P. up to the limit at which forcing the boilers commences. Beyond this point the *ratio* of consumption increases more rapidly than the H.P. Under test five it was remarked the time necessary for getting under way with water-tube boilers much depends on the time necessary for warming the engines; hence steam-jackets are necessary in large engines. In the case in point engines were started from cold water in 24 minutes and full speed attained in 33 minutes. Under test six as to the effect of the propeller to increase or decrease the speed of the vessel, the important result learned was that as regards time required to attain any given speed, the higher the speed to be attained the quicker the time in attaining it, and similarly on reversal; the higher the speed at the moment of reversal with the same speed of revolution the quicker the time in which the vessel was brought to rest, though naturally a longer distance is traversed in the shorter time for reversal at a high speed than at a lower one. The whole series of tests are most interesting.

Mr. Stromeyer, Chief Engineer of the Manchester Steam Users' Association, contributes also to the Institution of Naval Architects a most useful paper on practical experience of the strength of boilers which we regret that want of space prevents us doing full justice to. Mr. Stromeyer very pertinently puts it that, though general practice and particularly marine practice under the rules of the Board of Trade and of Lloyd's Register invariably produce safe boilers, the accepted rules and formulæ actually prevent us know-



The Japanese Torpedo-Boat Destroyer "Ikadsuchi," built by Messrs. Yarrow & Co., Ltd., London.

ing how much material we may waste in over-safety with the accompanying commercial disadvantage of over-weight. From the exceptional personal experience of the author in all varieties of failures of boilers he has come to the conclusion that experience as to the practical strength of boilers, flat plates or furnaces is still wanting, as no one would wilfully design or watch a weak boiler to find out by disaster how weak it was. Owing to the prevalence of lap-rivetted joints in flues no such furnace is truly cylindrical and unavoidable oval shapes and stresses are set up due to heat and longitudinal deformation. Nevertheless the author considered accepted formulæ for the resisting strength of furnace flues to be much underestimated and that collapse seldom ensues from direct crushing but from other subsidiary causes often overlooked—as the weakness of the flue from accepted formulæ is often much exaggerated. Details of many cases of collapse are dealt with, and the many important tests tabulated at the end of this paper form a most valuable paper of reference to those desiring practical checks upon accepted formulæ in the construction of boilers.

THE JAPANESE TORPEDO-BOAT DESTROYER.

MESSRS. YARROW are completing their order of six 31-knot destroyers for Japan. On December 11th a preliminary trial over the Maplin measured mile was run by the first of them, the *Ikadsuchi*, which we illustrate on page 3. She is a twin-screw boat of 220 ft. long, 20 ft. 6 in. beam, and propelled by two sets of four-crank triple-expansion engines balanced on the Yarrow, Schlick & Tweedy principle. The cylinders are 20½ in., 31½ in., and two low-pressure cylinders of 34 in. diameter, the stroke being 18 in. diameter. The steam is supplied by four Yarrow boilers. On trial the contract load of 35 tons was carried, and the contract speed of 31 knots was more than reached during four runs. The engines are designed to give 6,000 H.P., but it is estimated that 7,000 I.H.P. could be reached. The steam pressure was 185 lbs.; revolutions, 410 per min.; and the draught of the destroyer, 8 ft. 6 in. The armament consists of one 12-pounder quick-firing gun, mounted aft, and five six-pounder guns, and there are two torpedo-guns on deck for 18 in. torpedoes. The coal capacity is 90 tons, which would carry the boat across the Atlantic.

THE PREVENTION OF COLLISIONS AT SEA.

IT is perhaps no exaggeration to say that, of late years, there has been more destruction of life and property at sea, by collisions, than by any other cause. Since the advent of big steamers and high speeds, the risk of collision has been enormously increased, and we have pleasure in giving some particulars of an invention to prevent or minimise this source of disaster, namely, Anthony's Sound Locater.

This ingenious appliance is designed on scientific principles, and by its use on board ship the position of any steamer or lighthouse in the vicinity can be accurately indicated by the sound of the fog signal. An important feature of the invention is a large circular-mouthed sound collector, attached to which is a resonator against which the sound beats, and a cowl-shaped receiver, down which the sound travels from the resonator to the ear tubes.

Owing to the fact that the "receiver" end of the instrument is narrower than the "collector" end, the sound increases in volume as it passes through There is a dial placed on a suitable pedestal, and when the sound collector is revolved, the exact position at which the operator has found the object of his search is registered thereon.

The instrument has undergone many severe tests in the hands of experts, and the tests on every occasion have given satisfactory results. The fact that a large number of orders for the appliance have already been received, and that enquiries are still coming to hand from all parts, is a sufficient proof that the shipowners of the country have not been slow to discern its merits. The appliance has been patented by the inventor, Mr. James Anthony, Hamburg Chambers, Newcastle, and we believe a syndicate has been formed to undertake its manufacture and sale.

INSTITUTION OF NAVAL ARCHITECTS.

THE spring meeting of the Institution of Naval Architects took place on March 22nd, 23rd, and 24th in the hall of the Society of Arts, John Street, Adelphi, under the presidency of the Right Hon. the Earl of Hopetoun, G.C.M.G. Among those present were Sir William White, Sir John Durston, Sir Raylton Dixon, Sir E. J. Reed, Sir John Hay, Sir Benjamin Browne, Vice-Admiral Sir N. Bowden-Smith, Mr. J. Williamson, Director of Dockyards, Professor Elgar, Professor Biles, Messrs. J. I. Thornycroft, James Dunn, Andrew Laing, A. Betts Brown, James Thomson, J. Riley, Macfarlane Gray, B. Martell, J. T. Milton, J. Hamilton, J. M. Gray, F. K. Barnes, F. P. Purves, A. E. Seaton, J. H. Ellis, John Corry, Admiral Morant.

The President opened the proceedings by calling upon the secretary, Mr. George Holmes, to read the annual report of the Council. The Secretary then read as follows:—

"The Council are glad to report that, in the year which has just elapsed, the Institution has continued to prosper. The total receipts, as given in the accompanying statement, are somewhat less than in the preceding year. This is due to the fact that no summer meeting was held in 1898, and consequently less was received under the heading of entrance fees than in some recent years. The receipts from the permanent sources of income continue to be satisfactory. On the other side of the account, in consequence of temporary extra expenditure involved by the Congress, such, for instance, as the publication of an extra volume of the transactions, the disbursements last year were above the average.

"During the year, sixty-four new members were elected, while the losses due to deaths and withdrawals amounted to forty, leaving a net gain of twenty-four.

"The Council beg to inform the members that the President of the Institution, the Earl of Hopetoun, has lately been appointed by the Queen to fill the high office of Lord Chamberlain. They now announce with great pleasure that Lord Hopetoun's acceptance of this office will not entail the loss of his invaluable services to the Institution.

"The Council have much satisfaction in stating that they have received and accepted cordial invitations from the Mayor and Corporation of Newcastle-on-Tyne and the President and

Council of the North-East Coast Institution of Engineers and Shipbuilders to hold a meeting of our Institution at Newcastle-on-Tyne during the coming summer. Particulars of this meeting will be announced in due course.

"Under the regulations of the Committee of Lloyd's Register relating to the constitution of their sub-committee for surveyors, it became necessary last January to elect four representatives of this Institution on that committee. The Council accordingly elected Mr. James Dunn, Mr. Francis Elgar, LL.D., F.R.S., Mr. John Sampson, and Mr. Albert E. Seaton. These gentlemen have kindly consented to place their services at the disposal of the Institution.

"The Council have had great pleasure in awarding a gold medal to Professor Captain Kriloff, for his very able papers on 'The General Theory of the Oscillations of a Ship on Waves,' and 'On Stresses Experienced by a Ship in a Seaway'; and also to Professor Hele-Shaw for his two exceptionally valuable papers, describing his remarkable 'Investigation of the Nature of Surface Resistance of Water and of Stream-Line Motion under certain Experimental Conditions.' The Council feel that they are greatly indebted to Professor Hele-Shaw, who is not connected with the Institution, for freely placing the results of his prolonged investigation at the disposal of the members, and for publishing the results through the medium of our transactions.

"The Council have had for some time under consideration the rules for the election of members and associates. They have come to the conclusion that it is to the interests of the Institution that those rules should now be made somewhat more stringent, and that provision should be made for a class of associate members, intermediate between full members and associates. The proposed new rules, copies of which have been sent to all members and associates, will be submitted for adoption at the present meetings.

"Last summer the Council received a letter from the President of the Société des Ingénieurs Civils de France, inviting the presence of delegates of the Institution at the celebration of the fiftieth anniversary of the founding of the Société. The Council gratefully accepted the invitation, and their delegate was received with the kindness and hospitality which the French institution have always shown in their relations with our body.

"The Council deeply regret to announce the death of one of the vice-presidents of the institution, the late Mr. W. H. Tindall, Chairman of Lloyd's Register, and also of Sir William Gray and Mr. William Laird, members of Council. Since the last meeting the Institution has also lost one of its most distinguished foreign members, Herr Alfred Dietrich, constructor-in-chief of the Imperial German Navy, whose services to the Institution on the occasion of our visit to Berlin are fresh in the memories of all who took part in the German meetings. Herr Dietrich was a Gold Medallist of the Institution. The Institution has also to deplore the loss of Sir William Anderson, K.C.B., member, and of Sir John Fowler, K.C.M.G., associate, both eminent civil engineers; and of Messrs. W. B. Baskcomb, J. Brodie, W. McLaren, and J. Westwood, jun., members, and Lucas Thomasson, associate."

The President then delivered his opening address:—

"From the report which has just been read you will have gathered that the year 1898 has been less eventful than some of those which have preceded it. Nevertheless, much useful work has been done, and for the first time in the history of the Institution we have published two volumes of the transactions in one year.

"I deeply deplore the fact that the hand of death has lately been so busy in our ranks. Since last I had the pleasure of addressing you we have lost a vice-president and two members of Council, as well as a member and an associate of the Institution, who were amongst the most prominent engineers in the country, and also another member who had attained to the highest degree of eminence in his profession in his native land—Germany. Our late vice-president was chairman of Lloyd's Register—a most important position, which Mr. Tindall filled in an admirable manner. Of the two members of Council whom we have lost the name of one, Mr. William Laird, of Birkenhead, is known so well that I need hardly enlarge on his career at any great length. Mr. Laird was the head of a famous firm which was identified with the first introduction of iron shipbuilding. His father, the late Mr. John Laird, was one of our earliest vice-presidents; his brother, the late Mr Henry Laird, was a most valued member of Council; and I can say of Mr. William Laird that he has worthily maintained the traditions of his family. I am glad to say that the family of the Lairds is not deserting the Institution, as I notice that you have just elected as an associate member a son of Mr. Henry Laird, who is at present not of the full age required for membership. I am sure that we all sympathise with him in his recent heavy bereavement, and hope that he will one day attain to the same eminence in the Institution as have the other members of his family.

"Sir William Gray was an eminent shipbuilder at West Hartlepool, who by his enterprise and ability, attained very great success.

"Of the merits and achievements of Sir John Fowler, formerly president of the Institution of Civil Engineers, and of Sir William Anderson, formerly President of the Institution of Mechanical Engineers, I will not speak here, because their fame is of the highest, and I could not, in a few words, do justice to them.

"In Mr. Dietrich, Constructor-in-chief of the Imperial German Navy, we have lost not only a member of the highest capacity, but also one of our best friends and well-wishers. As your President during the delightful meeting we held in Germany, I know, perhaps better than most, how hard he worked to organise all the arrangements for our reception at Berlin. You, yourselves, are the best judges of the success which he achieved. I can only add with the sincerest regret that the Institution is distinctly the poorer for the loss of all these illustrious men.

"The Institution has lately lost another sincere friend, who though not one of our honorary members, always, when occasion arose, did his utmost to encourage us and to show us kindness and hospitality. I allude to M. Félix Faure, till lately the distinguished President of the French Republic. It was recently my sad duty to send a respectful letter of sympathy on your behalf to the French Ambassador condoling with His Excellency and his Government on the painfully sudden death of the Chief of their State. The late President, as I need hardly remind you, received the Institution with every honour when we visited Paris in 1895, and only last summer he sent to the Council a very kind message stating that he had not forgotten the pleasure which our visit had caused him, and that we had his best wishes for our future prosperity.

"Although the late Prince Alfred of Saxe-Coburg was not one of our members, we cannot forget that his father, H.R.H. the Duke of Saxe-Coburg, has for a long time been one of our vice-presidents, and that he lent us the most valuable support at the time of our International Congress. I am certain that I express the feelings of the whole Institution when I say that we deeply deplore the loss which has overtaken His Royal Highness and his house in the death of his only son.

"I will now turn to matters of a less painful nature. You have all heard from the Report of Council of the very friendly invitation which we have just received from the Mayor and Corporation of Newcastle-on-Tyne and the President and Council of the North-East Coast Institution of Engineers and Shipbuilders. You are no strangers to Tyne-side hospitality, for, twelve years ago, you paid a memorable visit to the city of Newcastle. In accepting the invitation which has been so warmly given, the Council feel certain that they will meet with your strong support in making the meeting a great success. Considering all that there is to see in the city and district, our visit cannot fail to be both interesting and instructive.

"The shipbuilding world during the past year has been in a state of intense activity, and this remark applies no less to the Royal Navy than to the Mercantile Marine. I feel, and I have much pleasure in doing so, that I may congratulate all who are engaged in the industry upon a state of unexampled prosperity.

"In my opening address last year I ventured to prophesy that everything pointed to there being shortly a great and continued revival in business, which would in some degree repair the losses suffered, both by employers and employed, through the deplorable labour dispute of 1897. This anticipation has been very fully realised. Both as regards work done and orders in hand, the year which has elapsed since our last meeting has been one of remarkable expansion in the shipbuilding industry, and this expansion bears striking testimony to the elasticity of our industries connected with marine construction. A very few figures will justify my contention.

"The output of tonnage of the United Kingdom in 1898 surpassed all previous records. The mercantile tonnage launched amounted to 1,367,000 tons—a total which exceeded that of 1897 by no less than 44 per cent. In addition to the above, warships with a total displacement of 196,000 tons were launched, and of this amount it may be interesting to note that more than three-fifths were built in private yards. These figures, taken together, exceed those of 1897 by 100 per cent.

"If we turn to orders in hand, the condition of things is equally satisfactory. The returns which I quoted last spring showed that the work then in hand amounted to no less than 1,023,000 tons—a condition of things, at the time, without precedent in the shipbuilding industry of the country, but which is at the present juncture entirely surpassed. The new mercantile shipping actually in progress, according to the latest statistics, reaches the huge total of 1,400,000 tons, showing an increase of nearly 40 per cent. over the corresponding figures of a year ago. In addition to this, there is now a vast number of warships under construction, amounting to a displacement of 410,000 tons, of which considerably more than half is being built in private yards. It is, moreover, generally understood that orders for new tonnage are still sufficiently numerous to give every prospect of full employment to our building yards for some time to come.

"Little commercial experience is needed to infer from figures like these that prices in all trades connected with shipbuilding must have been and are eminently satisfactory, at any rate from our point of view. The enormous pressure of work must have tended to stop that severity of competition which produces low, and perhaps unremunerative, rates. It is this abnormal demand for shipbuilding material which accounts for those instances in which American tenders for steel plates intended for vessels to be built in this country have been accepted, concerning which transactions alarmist articles in our newspapers are occasionally published.

"Striking testimony is borne by the figures which I have already given to the resources of our marine engine-builders, for, almost without exception, the vessels which were constructed last year, and those which are still being constructed in this country, are propelled by steam power. Less than one-third per cent. of the mercantile output of 1898 was made up of sailing tonnage, and the work now in hand consists even more completely of steamers.

"Gentlemen, we all know that this Institution is somewhat international in its character, and I may now congratulate our foreign members upon the fact that the revival in shipbuilding is by no means confined to one country. All our neighbours are feeling the benefit of it.

"The vanishing of the sailing vessel from the shipbuilding yards of the United Kingdom leads me to remark again upon the directly opposite tendency which is observable in France. In that country, fostered by certain provisions of the Bounty Laws, the construction of large steel sailing vessels is making rapid progress, while no proportionate expansion has taken place in the building of steamers. During 1898, the sailing tonnage launched by French shipbuilders amounted to upwards of 30,000 tons, and formed 45 per cent. of the total mercantile output of the country. These figures included twelve sailing vessels of 2,000 tons and upwards. At the present moment not less than twenty-six large sailing vessels, with an aggregate of 63,000 tons, are in hand or on order. The ultimate result of building so many vessels of a kind which the ordinary requirements of commerce do not appear to demand in other countries, will be watched with interest.

"In Italy also a great development of shipbuilding is taking place. The industry in that country, as in France, is affected by Bounty Laws. But there the expansion is found exclusively in steam tonnage. Shipping to the extent of 90,000 tons is now in hand or on order in Italy. This is nearly three times as much as was the case when we met last spring.

"Last year the first place among foreign countries in total output was held by the United States, a result mainly due to the large production of vessels built for the Great Lakes. In Germany at the present time 168,000 tons are now in course of construction, including eight steamers of 10,000 tons and upwards, as compared with only four vessels of such a size in hand in this country.

"Before I leave the subject of the Mercantile Marine, I must congratulate Messrs. Harland & Wolff upon the successful launch of that magnificent ship the *Oceanic*, the largest vessel now in existence, and having a greater length than any which has ever been built. Last year, in this place, I pointed out that our German friends had constructed the largest ships in 1897. Our good friend, Mr. Laeisz, of Hamburg, commenting subsequently on what I had said, wittily remarked, 'It is true that Britannia has this year waived the rule, but next year she will, no doubt, continue to rule the waves.' That prophecy has turned out to be true, and to our friends Mr. Ismay and Mr. Pirrie and to their colleagues must be given the credit of having fulfilled it. The *Oceanic* has been described so fully in the newspapers that I will not now refer to her details; but I may be allowed to express the hope that, after she has completed her trials, we may hear something more about her at this Institution.

"The figures which I have given above amply prove that the leading commercial nations of the world are largely increasing their mercantile fleets, in order to cope with the ever-growing demands of an expanding commerce. The majority of these nations, our own country included, are also adding extensively to the war navies upon which their commerce must ultimately rely for protection.

"If we glance at the list of ships built, or which were building, during the past year, for the Royal Navy, we must certainly admit that our Admiralty is alive to the great responsibilities which rest upon it, and is fully determined to meet them. The cost of these increased armaments is undoubtedly heavy; but no prudent citizen will grudge an expenditure which, after all, only amounts to a very moderate insurance on that vast seaborne trade which is the very lifeblood of our existence.

"With the wider questions of Admiralty policy we have nothing to do at this Institution, but all matters which relate to the nature of the ships being built for the Navy are necessarily of great interest to us. During the past year progress has been made upon sixteen new first-class battleships and seventeen first-class cruisers, exclusive of two which, though sanctioned, have not yet been commenced. In addition to the above there are now completing, or building, four second-class and seven third-class cruisers, besides vessels of smaller denominations, such as sloops, gunboats, and torpedo-boat destroyers. The battleships belong to three different groups. There are six of the *Canopus* class, six *Formidables*, which are an improved type of the *Majestic* class, and, lastly, the four ships of the supplementary programme which was sanctioned at the end of last Session and partially put in hand at the commencement of the present year. The four latter ships are intermediate in size between the *Formidable* and *Canopus* classes. They will have practically the same armament as the *Formidables*, but thinner armour. The vertical side armour is to be seven inches thick over a considerable portion of the body of the ship, tapering to the bow. The barbettes will have 11 in. and the casemates 6 in. armour, all of the latest and best quality. The speed at natural draught will be nineteen knots, which is greater than that of any of our other battleships. The following are the principal dimensions:—Length between perpendiculars, 405 ft.; breadth, extreme, 75 ft. 6 in.; mean draught, 26 ft. 6 in.; displacement, 14,000 tons.; power, 18,000 I.H.P.

"Of these sixteen ships seven are being built in private yards. All of them embody the latest improvements in design, armour, armament, and machinery. They are being built in homogeneous groups, each group capable of acting as an independent fleet, thus carrying out a policy which the Admiralty have adopted for some time past, and upon which they are entitled to the highest praise.

"The first-class cruisers actually in hand, or completed during the year, are also divided into three types. We have, first, seven out of the eight protected vessels of the *Andromeda* and *Diadem* classes of 11,000 tons displacement; then six armoured cruisers of the *Cressy* type of 12,000 tons, to which I alluded in my address last year; and four new ships of the *Drake* class, which are described as being armoured *Powerfuls*, 500 ft. long, 14,100 tons displacement, and having machinery capable of exerting 30,000 H.P. with estimated speed of 23 knots on trial. The main armament will be two 9·2 in. guns of improved type with armoured shields, and sixteen 6 in. quick-fire guns in casemates. The vertical side armour will be six inches thick over the main body of the ship, with armoured decks. The hulls will not be sheathed. The total bunker capacity will be 2,500 tons, and half this quantity will be carried on the speed trials.

"Nothing connected with the development of the Fleet is more remarkable than the extraordinary growth in the size of cruisers. The displacement of individual vessels has gone up by leaps and bounds from the time when the vessels of the *Edgar* class excited universal admiration. The largest cruisers of that date varied from 7,350 to 7,700 tons displacement, and 12,000 H.P., while each of the four cruisers above referred to has a displacement nearly double that of the *Edgar* and slightly exceeding that of the latest type of first-class battleships. The demand for increased speed, greater radius of action, and improved protection mainly accounts for this great growth in displacement.

"The two new cruisers, belonging to the special programme, which have not yet been commenced will be of more moderate dimensions. They will be 440 ft. long. of 9,800 tons displacement, 22,000 I.H.P., and their estimated speed at natural draught is 23 knots. Their armament will consist of fourteen 6-in. quick-fire guns, of which four will be in pairs in turrets and ten in casemates, the armour in each case being 4 in. thick. The vertical side armour over a considerable portion of the body of the ship will be of the same thickness, with thinner protection on the bows. There will be strong protective decks associated with the vertical armour, and the hulls will not be sheathed. The bunker capacity will be for 1,600 tons.

"The programme for the coming year embraces two first-class battleships, the design of which has not yet been settled, two armoured cruisers of 9,800 tons, three lesser cruisers, and sundry smaller vessels.

"I feel that I cannot dismiss this subject without saying a few words upon the vast amount of work and responsibility which the reconstruction of the Fleet, commenced on the passing of the Naval Defence Act in 1889, has entailed upon the Department of the Controller of the Navy. I don't suppose that the officials at the head of the Constructive and the Engineering Departments at the Admiralty have ever enjoyed sinecures; certainly they have not done so during the forty years which constitute the lifetime of this Institution; but, in the ten years which have elapsed since the framing of Lord George Hamilton's programme, it seems to me that work of a particularly onerous and responsible character has had to be performed. The outside public are, perhaps, apt to ignore all that is involved in carrying out a great programme of construction. They think that, when the money is voted and the building of the ships sanctioned, everything is done. They read with complacency that the country possesses so many ships — built, building, or projected—but they know little, or nothing, of the responsibilities and labours of those who have to settle what shall be the offensive and defensive powers, the speed, and the coal endurance of the ships, and of those who have to realise these qualities in the ultimate designs sent to the building yards. Equally little do they know of the splendid organisation and mechanical resources of the dockyards and of the great private building firms, an organisation which has recently resulted in a first-class battleship being launched within eight months of its commencement. Perhaps the cost of the work done may enable the public to appreciate to a certain extent the labours of those who serve them. For the ten years ending March 31st, 1898, the average annual expenditure on new ships, machinery, and gun-mountings has amounted to about four and a half millions sterling, which is, roughly, double the annual average outlay in the decade preceding the reconstruction of the Fleet. During the four years ending March 31st, 1898, the average expenditure has been £5,600,000 per annum, while in one year, 1896-97, as much as £7,327,000 was spent, and in the year upon which we are about to enter the cost of new work will nearly reach £9,000,000, a figure which is absolutely without precedent.

"When I consider the enormous importance to this country of its Navy and of its Mercantile Marine, and when I consider that both marines have been practically reconstructed within the last dozen years, and when I further reflect on the part which our members have played in effecting this reconstruction and in developing the inventions which have done so much towards perfecting the art of steam navigation, I cannot but think that this Institution of ours is playing a large part in the life of our country, and that no prouder position could fall to the lot of any man than to preside over its destinies. It is, therefore, peculiarly gratifying to me to feel that the duties which Her Majesty has been graciously pleased recently to confide to my care do not necessitate my severing my connection with you. I am grateful to the Council for the kindly reference which they have made regarding me personally in their Report, and I would assure you that I shall continue, to the best of my ability, to promote the interests and welfare of the Institution. I now beg to thank you for the patience with which you have heard me, and to move the adoption of the Report."

STEAM PIPES.*

By J. T. Milton, Esq., Member of Council, Chief Engineer Surveyor of Lloyd's Register of Shipping.

In 1895 the author had the honour of reading a paper on steam pipes before the members of this Institution, and it is thought that some further remarks upon the subject would not be out of place in view of its increasing importance. When it is remembered that there are in existence about 15,000 steam vessels of above 100 tons register, and that in any vessel the failure of a steam pipe may possibly lead to her total disablement, and that every day sees several additions to the number of vessels in which steam pipes of larger size and working at higher pressure are used, it will be realised that the subject is one which demands the attention and consideration of Marine Engineers.

When dealing with matters in general use, or coming under common observation, there is no doubt that a few failures teach their lessons more emphatically than a large number of successes, and, therefore, in this paper reference will be made to some of those cases of accidents to steam pipes which have been publicly inquired into under the provisions of the Boiler Explosions Acts of 1882 and 1890. A summary of all the cases which have been so inquired into is given in the Appendix to this paper, but it must not be thought that these are all the serious accidents to steam pipes which have happened, as many failures occur which are repaired without the facts becoming known to the officials whose business it is to hold these inquiries.

It will be seen from the Appendix that in none of the cases has failure occurred through original weakness of the pipes themselves, that is to say, through their being originally made too thin. In the majority of cases the troubles have arisen through the design of the pipes having been at fault. In fourteen out of the sixty-eight cases referred to, the accident occurred through there being no provision for draining the collection of condensed water from the pipes; while in no less than thirty-eight, or more than half of the total accidents, there was insufficient provision for expansion and contraction, and for the motion due to vibration, &c., and in many of these cases similar accidents had previously occurred without being inquired into. In a few cases the explosions occurred either through original defective workmanship or through defects which subsequently developed in the pipes.

It will be well to first consider the materials used for pipes before dealing with the question of design, as the latter has to be made to suit the materials employed.

The materials in general use for main steam pipes are copper, used either in the form of seamless or of brazed tubes; wrought iron, generally lap-welded; steel, also lap-welded, and sometimes fitted in addition with a rivetted butt strap covering the welded joint; cast-iron has been employed in a few cases, as also has seamless steel. Small steam pipes for auxiliary purposes are almost invariably made of copper. In a few cases, however, they have been made with seamless steel.

Of these materials copper is by far the most common. Formerly nearly all copper pipes were made from sheet copper, with brazed lap joints; straight pipes, except in the largest sizes, being made with one seam. Bends of small pipes are generally made from straight tubes; large bends, however, are made from two sheets, worked into shape by the coppersmith, and brazed along two seams. Recently improvements in manufacture have enabled seamless tubes to be made at reasonable prices, so that, up to about 6 or 7 in. diameter, most steam pipes are now made from seamless tubes, which are bent by the coppersmith into the shapes required. Generally the flanges are brazed on the pipes, but in a few cases special patent flanges are adopted, enabling brazing to be dispensed with.

That want of confidence is felt in copper pipes by the Admiralty and by some engineers is shown by their wrapping them with copper wire, or by steel wire rope, or by fitting wrought iron bands at short distances apart along their whole length.

Copper probably owes its present extended use mainly to custom, and its first selection was, no doubt, due to its non-liability to corrosion and to its great ductility. The latter, however, is a variable quantity, depending largely upon the treatment to which it has been subjected, and depending also upon its composition.

---

*[Read at the Fortieth Session of the Institution of Naval Architects March 23rd, 1899.]

When copper has been thoroughly annealed, it is very soft, and a very low stress, say, even less than two tons per square inch, will produce a slight permanent set. As the stress increases the deformation increases more rapidly, and at a tensile stress of from 13 to 14 tons per square inch, calculated from the original section, fracture will take place. In the case of good copper, which has been previously properly annealed, the elongation in 8 in. will be about 30 to 40 per cent. If the copper is stressed to any less amount than its ultimate strength, and the load released, it will be found that the stress has *hardened* the copper, and that the metal will then be practically elastic up to nearly its original load, less stress than this producing no further permanent elongation. If after this hardening the copper is again annealed, it will behave as it did in its original annealed state, a low stress again producing a permanent elongation.

The effect of hardening upon the extension, and the apparent ultimate strength of copper, is well illustrated by the accompanying autographic diagrams of tests made by Professor W. C. Unwin on specimens of copper, one being annealed and the other fairly hard. Fig. 1 represents the tests on the annealed, and Fig. 2 upon the other specimen. In these figures vertical distances represent the total load upon the specimens, and horizontal distances represent upon a scale of twice the full size the elongation in an original length of 8 in.

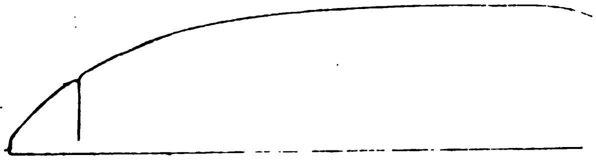


FIG. 1

The particulars of the actual tests are given in the table below.

The nearly vertical line at the commencement of each curve shows that the elasticity of the material was at first nearly or quite perfect, the falling away of the curve from the vertical portion shows the elongation which takes place after the elastic limit is passed. In the case of the hard copper, it appears that after the material has commenced to stretch, the application of the same load continues to elongate it. In the case of the soft specimen a low stress commences to stretch it, but until nearly half of the total elongation is reached, each successive increment of stretch requires a higher stress to produce it.

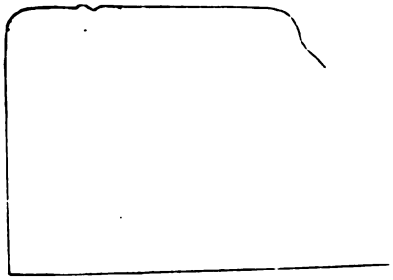


FIG. 2.

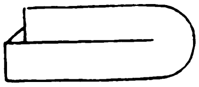
The break in the curve was produced by relieving the stress after an extension of one-third of an inch. On the load being re-applied, it will be seen that the elastic limit had been raised by the previous testing from 1·769 to 6·9 tons per square inch.

Dimensions.		Section.	Stress at Elastic Limit.	Maxm. Stress in Tons.	Elongation in 8 in.	Rem'rks
Width.	Thick.					
In.	In.	Sq. in.	Tons per sq. in.	Per sq. in.	Per cent.	
1·503	0·188	0·2826	1·769	13·03	48·13	Anneal'd
1·498	0·193	0·2891	15·56	16·13	17·88	Hard.

The lower ultimate strength shown by the annealed piece of copper is due to the stress being calculated from the original area, the great extension of the soft specimen causing more contraction of area than occurs with the harder specimen. If the stress actually borne by the two pieces is referred to the actual reduced section at the moment when each is withstanding the maximum load, it will be found that the results are approximately equal in these two cases. This shows the importance, when testing copper for the purpose of ascertaining its quality, of being careful that the specimen is properly annealed before the test.

Hardening of copper may be produced in other ways than by direct tension. Copper wire is hardened by continual bending and straightening; sheet copper is hardened by hammering or by cold rolling; pipes may be hardened by planishing or by being hammered or bent whilst they are "loaded," and copper tubes are always hardened when they are drawn on a drawbench either to a smaller diameter or to a thinner gauge. In whatever way copper is hardened its ductility is correspondingly lessened, and in all cases the hardening may be removed by "annealing," that is by raising it to a bright red heat, and either quenching it in water, or allowing it to cool gradually.

Commercial copper, as used for other than electrical purposes, is rarely pure, or even nearly pure. The effects of some of the common impurities, such as arsenic, nickel, and silver, are supposed not to be detrimental; while, on the other hand, antimony is objectionable, and bismuth, even in small traces, is exceedingly prejudicial. The usual workshop test for the quality of copper is to cut off a portion of the pipe or sheet and anneal it when it should stand bending quite close, thus, without a sign of cracking. The edges also should stand thinning to a knife-edge without crack when hammered to a scarf joint form with a lap of about three or four times the thickness of the copper.



Brazing solder is composed of copper and zinc, in about equal proportions; occasionally, however, ½ per cent. of tin is added to the mixture. The mixed metal is first cast in iron ingot moulds, then it is reheated to a certain temperature, considerably below red heat, at which it becomes brittle, and is pounded up with an iron pestle and mortar. The addition of the small quantity of tin is said to facilitate the pounding. It thus appears that at a temperature intermediate between that of the steam and a red heat, the solder becomes brittle, and unfit to sustain any stress.

It is usually considered that the brazing solder, like copper, is not liable to corrosion, and in the majority of cases in which brazed copper steam pipes have been cut up after many years of service, the brazing is found to be in as good condition as the copper. In a few cases, however, the brazing of copper steam pipes has been found to have deteriorated in use to an alarming extent. Attention was first drawn to this in the case of the fatal explosion of the steam pipe of the s.s. *Prodano*, referred to in the Appendix as No. 1,033. After the official inquiry into the matter, this case was investigated by Professor Arnold, of Sheffield, whose report was published in *Engineering*, Vol. LXV. p. 468, and *The Engineer*, Vol. LXXXV. p. 363. Professor Arnold showed that the brazing in this and in another case submitted to him at the same time had deteriorated by the whole of the zinc in some parts of the solder becoming oxydised, the copper remaining in the form of a spongy metallic mass, the pores of which were filled with the oxydised zinc. He attributed this result to electrolytic action set up by fatty acids produced in the boiler or in the steam pipe from the decomposition of organic oils, as he found and separated these organic acids from the deteriorated solder. Since attention was drawn to these cases, a few other steam pipes have been found to have been similarly depreciated in their brazing.

It is worthy of note that experience with Muntz metal exposed to the corrosive action of sea water shows that a somewhat similar deterioration of the zinc takes place. It is said that this is prevented if a small quantity of tin is added to the mixture; but in the cases of the brazing solder investigated by Professor Arnold, one specimen which originally contained ½ per cent. of tin was equally affected to that composed of copper and zinc only.

The properties of wrought iron, mild steel, and cast iron are too well known to require lengthened description. In making either wrought iron or mild steel welded steam pipes, the tubes are made from rolled strips or plates, the edges of which are bevelled by machine, and the weld is always lap, not butt. In all but the largest sizes the welding is done in rolls at one heat the whole length, but in the largest sizes of pipes it is done piece by piece in a similar way to the welding of boiler furnaces. In wrought iron a free welding quality is usually selected in preference to a very strong iron, soundness of weld being considered to be of the first importance. In mild steel the very mildest qualities are selected for the same reason. With either material the requirements of manufacture, except in the cases of the very largest pipes, are such that the thickness is in excess of the requirements of strength for such steam pressures as are now in use, so that when iron or steel pipes are used a very large margin of strength is always provided.

In the case of wrought iron pipes it is usual to trust to the welded joint, but in the case of mild steel, in some cases a rivetted butt strap has been fitted as an extra precaution over the welded joint. Experience, however, with steel lap-welded boiler and other tubes has shown that, with the mild qualities of material actually used, as reliable welds can be made with steel as with wrought iron. It need hardly be pointed out that butt straps add considerably to the weight and cost, and that every needless rivet hole is a possible source of leakage and trouble, so that if the welds are really efficient, and if they could be tested so as to practically eliminate the probability of defective workmanship, butt straps would soon be dispensed with.

To put such a high hydraulic test upon welded steel as would really stress the material to nearly its elastic strength is impossible, except with the largest pipes, owing to the thickness adopted being much greater than is needed from the requirements of strength alone, and the fact that such pressures would strain the flanges and flange fastenings, but tests of three or four times the working pressure can always be made. It has been suggested by some pipe makers that, to give confidence in the welds, each steel pipe should be made somewhat longer than is actually required, and that test pieces should be cut off from one or both the ends before flanging and opened out and tested in a testing machine across the weld. In addition, of course, a high hydraulic test would be made after the flanges are fitted.

Flanges for wrought iron or steel pipes may be welded to the pipes, but usually they are screwed on. In some cases they have been rivetted to the pipes. Successful plans are shown in Fig. 3, in which the flanges have been forged out of the solid, without weld, and screwed on the pipe with a diminishing thread. The thread extends through the whole thickness of flange, but in more recent practice the flange overlaps a part of the pipe without thread. In either case the flanges are caulked on both sides to ensure steam tightness.

When wrought iron or steel pipes are used, the designs are generally made so that individual pipes are straight or nearly so. It may be of interest, however, to know that if bent pipes are really required they can be made with a radius of three times the bore for pipes below 6 in. diameter, and four times the bore for pipes up to 12 in.

In the paper of 1895 it was stated that cast iron steam pipes had been used with success for many years, and a list was given of several vessels in which such pipes were fitted, and the periods during which they were in use were also recorded. In most of these vessels the cast iron pipes are still in service. The almost invariable use of cast iron for stop valve chests, &c., shows that as a material it can be relied upon for strength and durability, and the experiences with the vessels referred to show that pipe designs can be made permitting the use of rigid material.

When wrought iron or steel pipes have been used for modern vessels, experience has shown them to be admirably adapted for their purpose, and no trouble whatever has been experienced with regard to their corrosion.

Having now discussed the qualities of the different materials used for steam pipes, it will be well to refer to the conditions which the pipes have to fulfil in actual use.

The first condition to be noticed is that the pipes have to be

THE NEW
PUBLIC LIB
ASTOR, LENOX
TILDEN FOUNDA

Fig. 3

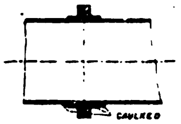
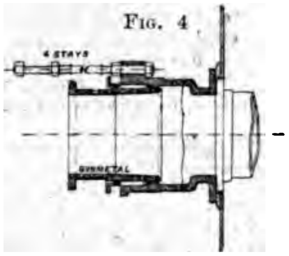


Fig. 4



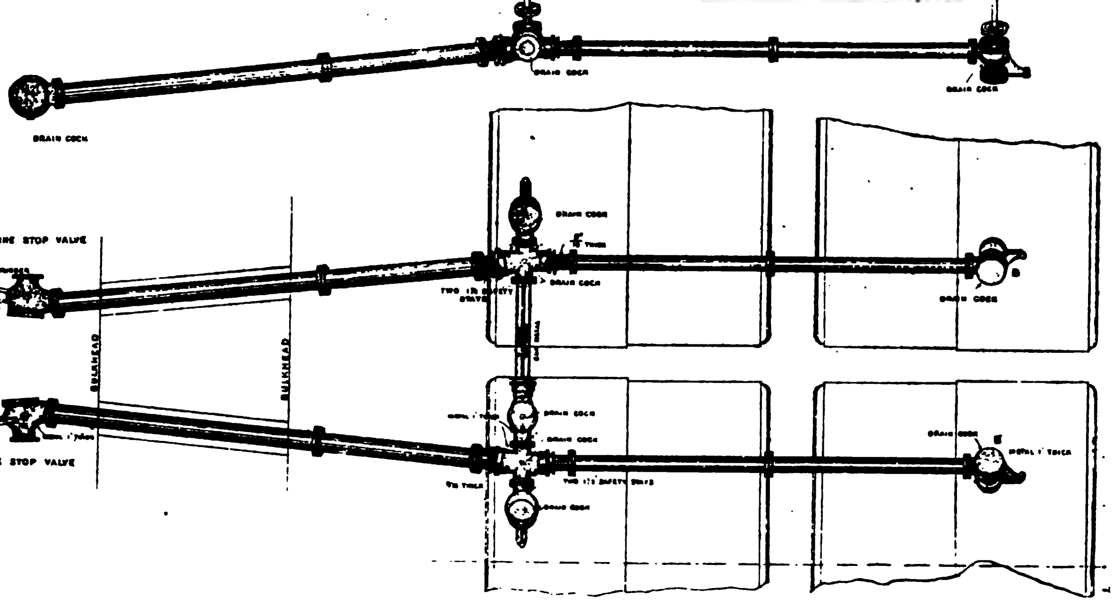


Fig. 6.

strong enough to withstand the pressure to which they are to be subjected. In the case of wrought iron or steel, as has already been stated, conditions of manufacture require such a thickness that the strength is more than ample. Copper pipes, however, may easily be made of less strength than sufficient. The usual practice of marine engineers is to take the Board of Trade Rule as a minimum. The rule is as follows:—

Thickness in inches

$$= \frac{P \times D}{6{,}000} + \frac{1}{16} \text{ in.}$$

for brazed pipes, and for seamless pipes not over 8 in. wide

$$= \frac{P \times D}{6{,}000} + \frac{1}{32} \text{ in.}$$

P being the working pressure in lbs. per square inch, and D the inside diameter in inches.

When making copper pipe, either from sheet or from straight lengths of tube, it is usual to make the bends from material one gauge thicker than would be used for straight lengths, and if the bends are very severe, to use two gauges thicker. This is necessary, as the material at the back of the bends is thinned in working. It must not be lost sight of that the extra thickness remains over the greater portion of the pipe, which is therefore rendered more rigid than it would be if it were uniformly of the minimum thickness.

Regarding questions of strength only, it is well known that, in cylinders subjected to internal pressure, the circumferential stress produced in the material is double that in a longitudinal direction. A pipe under hydraulic pressure will therefore always yield first by bursting open along the line of least strength, usually the seam. A reference to the failures which have actually occurred in practice, however, as given in the Appendix, shows that most of the fractures occur circumferentially at or near the flanges, and are obviously due to longitudinal stresses. The causes of these must therefore be looked for from other than internal pressure.

The next condition to be noted is that when in use the pipes will be much hotter than when they are fitted up, or when not in use. The temperature of steam at 200 lbs. pressure—a common pressure now—is 388° F. At 300 lbs., at which some boilers are being worked, the temperature is 422°, so that when in use the temperature of the pipes may be from 350° to 390°, or even more in excess of that at which they are fitted up. The coefficient of expansion of iron or mild steel for a range of 360° is ·0024, and that of copper is ·0037. Pipes, therefore, of these materials will tend to become longer when in use by these amounts. In addition to this the boiler itself, to which one end of the length of pipe is attached, also expands, and thus raises one end of the pipe from 3/16 in. to ½ in., according to the size of the boiler, while the end attached to the engine remains stationary. The necessary alteration of form of the pipes to allow for these expansions must be provided for in the design of the steam pipes, either by providing properly constructed expansion joints, which will allow the requisite freedom of motion, or by making the pipes of such form that the movements can take place, owing to the ductility of the material, without producing undue stresses on the pipes themselves, or on their connections to the stop valves and engines.

When cast iron or wrought iron pipes are employed, it is usual to consider that their rigidity is too great to allow of the expansion to be accommodated by the flexibility of the pipes themselves, and generally, therefore, expansion joints are fitted to them. An example of such a joint is shown in detail in Fig. 4.

With copper pipes, however, it is more often considered that the pipes will be sufficiently flexible, and the material sufficiently ductile, to permit of their repeated contraction and expansion without the need of stuffing-box expansion joints and consequently these are rarely fitted. Undoubtedly pipes can be made sufficiently flexible to meet all practical requirements; but, unfortunately, many of the designs in general use, sometimes combined with the faulty workmanship of not properly annealing the pipes, are such as to give continued trouble in keeping the flange joints tight and in some instances also in producing rupture of the pipes at or near the flanges. Some of these designs will be presently referred to.

It must be borne in mind that the hollow cylindrical form is one naturally possessing great strength and rigidity in proportion to its weight, and hence its general use for columns, &c., *where stiffness is required.* This property is often forgotten *when dealing with pipes, and they are often credited* with far more flexibility than they possess. In questions dealing with the rigidity or flexibility of pipes, it is well to remember that if a solid bar and a hollow tube of the same material, and the same length and shape, are subjected to the same loading, producing either traverse bending or torsion, or the two combined, the deflections will be identical if the diameter of the solid bar be equal to

$$\sqrt[4]{D^4 - d^4},$$

where D and *d* are the outside and inside diameter of the pipe. A bar of this diameter may therefore be looked upon as the equivalent of the tube when considering its flexibility, and if such a bar be flanged at the ends like the pipe, and attached to the stop valves, &c., by the flanges, the strains which the expansion, &c., will put upon the flanges of the stop valves will be the same by the bar or by the tube.

Let us now consider a pipe such as is commonly employed, say, such as fitted in one of the cases referred to in the Appendix. This pipe forms a right-angled bend, the two arms being 2 ft. and 6 ft. long respectively, the inside diameter of the pipe is 6 in., and its thickness is ·212, so that its stiffness or rigidity is equal to that of a solid bar of copper 4⅛ in. diameter. The expansion due to its temperature would, if not resisted, increase the lengths of the two arms by over 1/12 in. and ¼ in. respectively, and in addition one end is raised up by the expansion of the boiler about ½ in. The pipe therefore has to have such forces applied to the flanges at the two ends as would bend a solid bar 4⅛ in. diameter till the arms were shortened by the amounts mentioned, as well as displace one end ½ in. vertically, and at the same time there must be such bending moments applied to the ends as will keep the flanges in the same plane. These forces have to be borne by the thin metal of the copper pipe at the parts where it is brazed to the flanges. If a larger pipe were considered the forces involved would be even greater in proportion. If the copper is at first well annealed, these forces, being more than sufficient to produce stresses beyond the limits of elasticity, will doubtless permanently alter the shape of the pipe. At the parts where deformation takes place the copper will be somewhat hardened. When the pipe is cooled down it will tend to regain its original shape and length, and strains will be set up in it of opposite character to those caused by heating it. Each raising and lowering of steam will therefore bring alternating stresses on the pipe, each time tending to harden the material and decrease its ductility at those parts where most deformation takes place. There is no wonder, therefore, that in time the whole of the ductility is destroyed, and the pipe cracks round near one or both flanges.

From the diagrams shown in Figs. 1 and 2 it will be evident that, while on the one hand the more thoroughly annealed the material of the pipe is the more easily it will be deformed, yet, on the other hand, when well annealed the yielding power or ductility of the copper is such that very considerable deformation can take place without danger. Fig. 2, however, shows that with hard copper very much less yield can take place without the production of great strains, and consequently of great risk.

It may be well to point out that the expansion of iron is only about two-thirds of that of copper, so that the deformation in an iron pipe would be only two-thirds of that of a copper pipe; but, on the other hand, it is a stronger material, and in general, iron pipes would be thicker than those of copper, so that with iron there is considerably less flexibility than with copper.

When copper pipes have to take up the expansion and contraction by their alteration of form, it cannot be too strongly urged that they should be annealed uniformly throughout their whole length. Unfortunately the practice on this point is not well established. Some coppersmiths are particular in seeing that this is done; generally, however, only the bends, that is the parts where the pipes have been bent and therefore extra hardened, are annealed, the straight portions being left unannealed, whilst other coppersmiths leave even the bends unannealed. The portions near the flanges always become annealed when the flanges are brazed on, and unless the pipes are afterwards annealed their whole length it happens that the whole of the deformation strains become concentrated upon the soft part at the flanges where there is the greatest tendency for rupture to be produced.

From what has been stated, it would appear to be desirable that copper pipes, which have to take up expansion deformations, should be periodically annealed. This, however, brings up the question as to how the annealing of a bent pipe can be effected. The workshop practice is at best a makeshift one, the usual, and practically the only plan, being to heat successive portions of the pipe over an open coke fire, the workman turning it round and shifting it about over the fire until each part in turn is thought to have been raised to a red heat. Irrespective of the difficulty of getting the inner side of a large bend near the coke fire, this method leaves much to be desired, and involves a great risk of some parts being left hard, while the remainder is annealed. An unhomogeneous pipe may be in a worse condition than one wholly unannealed, and hence the reluctance of marine engineers generally to have pipes which have been satisfactorily at work for some time taken down and possibly injured in the attempt to anneal them. It is not too much to ask that our engineers should, if they will continue to use large and thick copper pipes, provide proper furnaces where the pipes may be uniformly heated throughout their whole length at one operation.

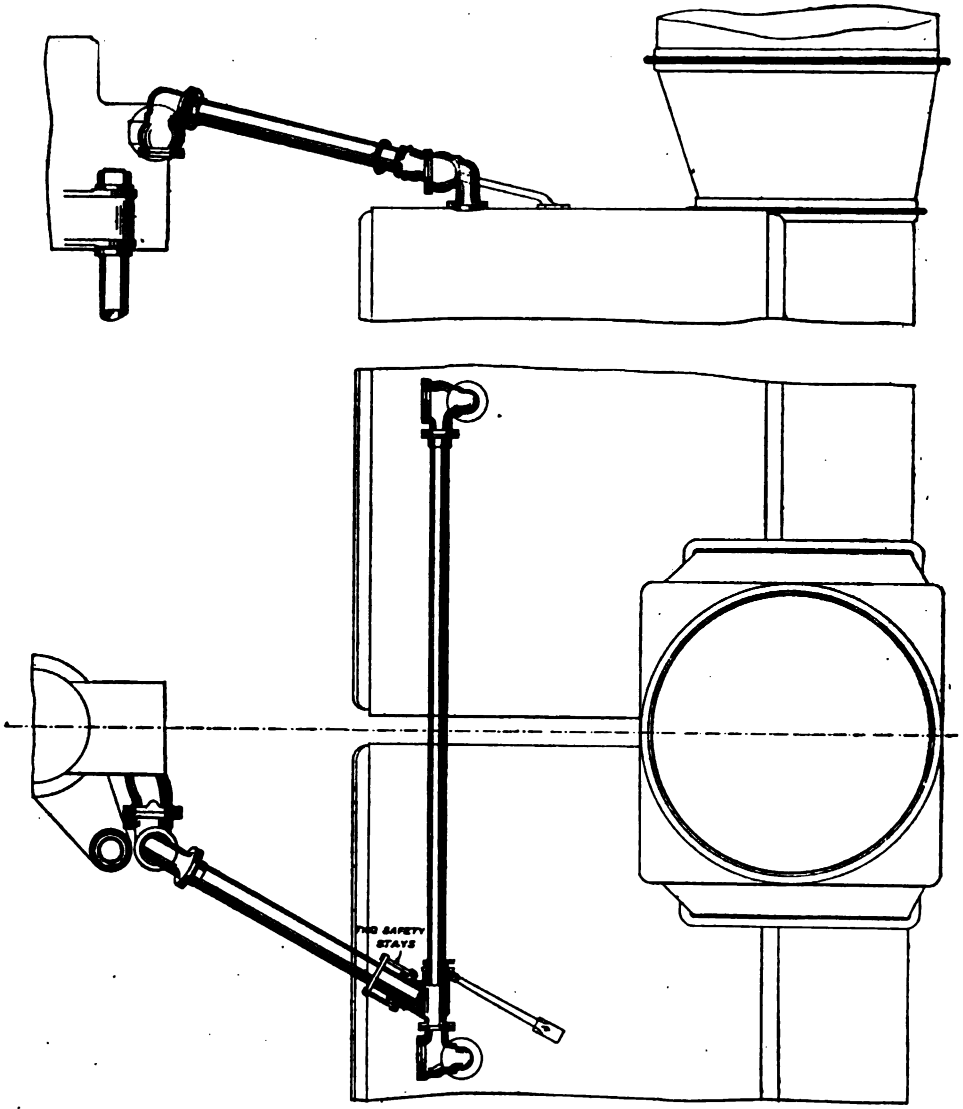


Fig. 5.

There is, however, no absolute necessity in most cases for using bent pipes. Straight pipes can nearly always be designed to meet all requirements, and the expansion of these can be provided for by expansion joints of the form shown in Fig. 4. These joints are, it is true, objected to by some engineers as being likely to be a continual source of trouble, but that this is not a correct view is shown by the fact that in our very largest mail boats they have been fitted and found to present no great difficulty in keeping them in order, while one of the largest engineering firms on the East Coast have practically used no other design for very many years for their main steam pipes, and their engines and arrangements are at least as popular as those of any of their competitors. Further, it must be remembered that, even if some trouble is experienced in keeping stuffing boxes in order, serious troubles with leaky joints are by no means unknown, where the expansion has to be met by straining the pipes themselves. Figs. 5, 6, and 7 represent plans which have been successfully adopted for steam pipes in which all the pipes are practically straight and the expansion provided for by expansion joints.

In providing for the expansion to be taken up by expansion joints, it is necessary to ensure that the lengthening of the pipe shall really take place by pushing into the joint meant to receive it, and that on the contrary the end of the pipe shall neither be stationary in the joint nor drawn out of it. This can only be ensured by making arrangements for fixing the expansion joint in position, and also securing the other end of the pipe to a fixed position, either by means of long stays attached to the expansion joint itself or by some other means.

The blowing out of the pipe by the steam pressure may possibly take place if there is a large bend in the pipe, as is seen in some designs. In such cases the preventive fastening should be secured to the bend, not to the pipe near its free end. Expansion joints are often fitted with what are called safety stays to prevent the pipe being blown out. When these are short and fitted too near the free end of the pipe they are either useless, or the expansion joint itself is useless, as they cannot come into service if the pipe expands into the joint as it is intended to do. They may moreover be an absolute source of danger, and at least one of the failures of steam pipes recorded in the Appendix was due to their being fitted. When steam is up and the pipe expanded the safety flange should be some distance off the nuts of the stays. If in this condition the nuts are thoughtlessly or ignorantly screwed up to the flange, on the pipes cooling down and contracting they will be subjected to great strains, and something must fracture to relieve them. If such stays are fitted, therefore, the nuts on them should be carefully adjusted when cold and be *fixed* in place, either by pins through them, or by ferrules placed over the stays of such a length that the nuts cannot be screwed down too far. Properly designed pipes, however, will not need these stays at all. In none of the plans shown in Figs. 5, 6, or 7 are these stays really required, although they have been fitted.

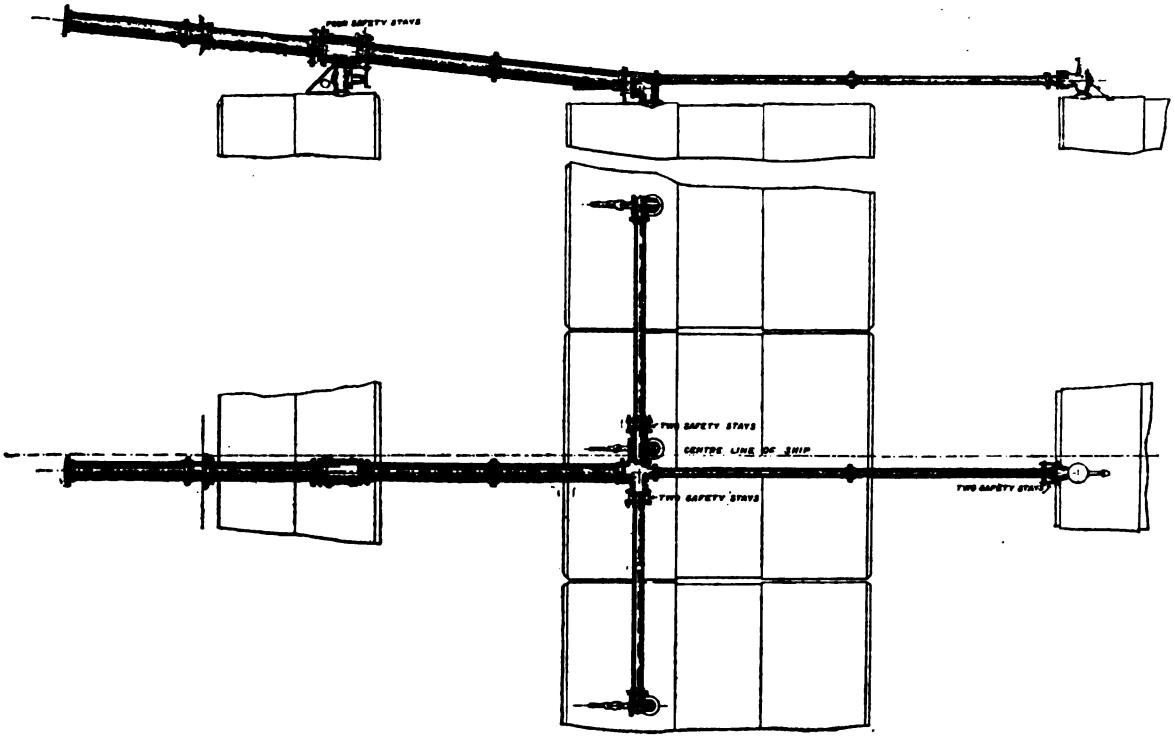


FIG. 7

Whilst referring to the expansion of pipes it will be well to call attention to the methods of supporting long lengths of pipe. These should be so arranged that while giving the necessary support and preventing vibration, they will not of themselves prevent the movement of the pipes due to their expansion and that of the boilers. If this is not provided for, the supports may possibly put much greater stresses on the pipes than would result from their being left altogether unsupported. Unfortunately, this point is often neglected by the designer, the hangers being arranged on the vessel by the mechanics, who fit them in place, who may not fully appreciate all their requirements.

The remaining point, as regards pipe design, is the necessity of providing for means of freeing the pipes from water which may accumulate in them. In installations where there is more *than one* boiler it may at any time happen that for some reason *steam is not raised in all the boilers* at once; the pipes connected to those boilers not in use may form not only condensers, but also convenient receptacles for the water condensed from leakage into them from the stop valves of the boilers under steam. Provision should always be made for draining any part of the pipes where water can accumulate, and too great care cannot be taken, when opening stop valves, to connect a boiler with others already in use, to ensure that there is no water in any of the pipes. Fourteen of the explosions referred to in the Appendix were thought to have been caused by want of attention to these points.

It is hoped that this paper will call special attention to the design of steam pipes, and elicit the opinions of our experienced engineers, with a view of improvements being effected, so that such casualties as have been referred to may in the future be less frequently met with.

APPENDIX.

LIST OF CASES OF CASUALTIES TO STEAM PIPES, &C., INQUIRED INTO UNDER THE PROVISIONS OF THE BOILER EXPLOSIONS ACTS OF 1882 AND 1890.

No. of Inquiry.	Name of Vessel.	Date.	Remarks.
120	S.S. Simoom	1885	Explosion of copper bellows expansion joint, which was constructively weak.
169	Ranger	1886	Cast-iron pipe, 6¼ in. diameter, decayed where it passed through the up-take, and was exposed to heat. Pipe was 26 years old,
238	Elbe	1887	Explosion of copper pipe, which was probably cracked in the process of manufacture.
277	Erin	1888	Wrought-iron pipe connecting top of water gauge to boiler corroded. Pipe was 20 years old.
299	Bryn Glas	1888	Intermediate stop valve cover broke, attributed to the wheel for opening the valve being turned the wrong way.

389	Clyde	1890	Winch stop valve broken at flange, through insufficient provision for expansion of pipe.
453	Springbok	1890	Main steam pipe broke at flange, through want of provision for expansion. Four times previously repaired at same place.
460	Jumna	1890	Main steam pipe burst at lap; probably due to defective workmanship at original brazing.
468	Number Three	1891	5½ in. copper pipe burst at brazed joint of a bend. Brazing was thought to have been defective, and the accident was attributed to the presence of water in the pipe.
480	Greencastle	1891	Copper steam pipe broke at flange, through expansion joint fitted being useless.
512	Rohilla	1891	Copper pipe, 14 in. diameter, failed at seam. Accident attributed to presence of water in the pipe.
530	City of Lincoln	1891	Copper pipe cracked through solid copper at edge of brazed seam. Accident attributed to water in pipe, and existence of old flaws in the copper.
543	Ragusa	1892	Copper pipe, 6 in. diameter, fractured circumferentially at flange connecting it to stop valve. Four times previously repaired. Want of provision for expansion.
556	Lockmore	1892	Branch of stop valve chest broke off, through expansion joint being inefficient.
572	Shannon	1892	Copper pipe, 8 in. diameter, broke at flange; attributed to presence of water in pipes.
578	Vulcan	1892	Copper pipe, 6 in. diameter, failed at brazing of seam.
580	Grimsby	1892	Copper main steam pipe burst at part adjacent to brazed seam. Attributed to water in pipe.
584	Astrion	1892	Copper pipe burst at a junction piece. Failure attributed to insufficient provision for expansion. Pipe had been several times previously repaired.
589	Vivla	1892	Cast-iron stop valve chest burst, through accumulation of water.
657	Othello	1893	Copper pipe broke at flange, through insufficient provision for expansion.
659	Astrakhan	1893	Copper winch steam pipe broke at flange, attributed to water in pipe.
718	Urpeth	1894	Copper main steam pipe broke at flange, through inefficient provision for expansion.
728	Beresford	1894	Copper steam pipe, 4½ in. diameter broke at flange, through want of provision for expansion. There were two similar failures at short intervals
742	Raglan	1894	Copper steam pipe 7½ in. diameter, broke at flange, through insufficient provision for expansion. Had previously failed in same way, and had been repaired.
749	Iron King	1894	Copper main steam pipe broke at flange, through insufficient provision for expansion. Had previously failed in same way, and had been repaired.
767	Metal	1894	Copper main steam pipe broke at flange through insufficient provision for expansion.
772	Iron King	1894	Copper pipe, fitted five months previously, broke at flange, through insufficient provision for expansion. This new pipe had previously been three times repaired.
775	Cornhill	1894	Copper pipe broke at flange, through want of provision for expansion.
833	Seaham Harbour	1895	Copper junction piece burst. Want of proper provision for expansion. Had been previously repaired.
854	Danehill	1895	Copper main steam pipe broke at flange, through want of provision for expansion.
915	Ethel	1895	Copper main steam pipe broke at flange, through want of provision for expansion. Had previously failed, and had been repaired.
925	Scot	1895	Auxiliary steam pipe failed, through defective brazing of flange.
929	Sabrina	1895	Cast-iron stop valve chest burst, attributed to water in pipes.
930	England	1896	Cast-iron stop valve chest burst, due to corrosion; 22 years old.
933	Orient	1896	Main steam pipe failed at brazing, attributed to water in pipes.
934	Sarpedon	1896	Cast-iron stop valve chest burst, attributed to water in pipes, and possibly original defect of chest.
943	Vane Tempest	1896	Copper main steam pipe broke at flange. Insufficient provision for expansion.
945	Mobile	1896	Copper main steam pipe broke at flange. Insufficient provision for expansion.
948	Verax	1896	Copper main steam pipe broke at flange, through insufficient provision for expansion.
958	Bencliff	1896	Copper main steam pipe, 5 in. diameter, broke at flange, through insufficient provision for expansion. This pipe had been been fitted with iron bands at 8 in. intervals.
970	Pectan	1896	Copper main steam pipe broke at flange, through insufficient provision for expansion.
971	Lapland	1896	Cast-iron valve chest broke at flange connecting it to engines; 24 years old.
986	Urmston Grange	1896	Copper pipe 3½ in. diameter burst. Probably original defective workmanship.
992	Indrapura	1897	Copper main steam pipe broke at flange, through insufficient provision for expansion.
1,003	Anglia	1897	Cast-iron stop valve chest broke at flange, through collision of vessel.
1,011	Nedjed	1897	Copper steam pipe, 9½ in. diameter, broke at flange, through want of provision for expansion.
1,013	Dalmally	1897	Copper main steam pipe broke at flange, through want of provision for expansion.
1,015	Selma	1897	Copper main steam pipe broke at flange, through want of provision for expansion
1,021	Aberdare	1897	Copper main steam pipe broke at flange, through want of provision for expansion.
1,024	Birdoswald	1897	Copper pipe, 5½ in. diameter, broke at flange, through want of provision for expansion. Previously there were four similar failures in this vessel.
1,033	Prodano	1897	Main steam pipe burst, through failure of brazing of steam.
1,034	Ethelburga	1897	Small gun-metal stop valve burst, through faulty design.
1,035	Keemun	1897	Copper steam pipe broke at both flanges, due to want of provision for expansion.
1,036	Bendi	1897	Copper main steam pipe broke at flange. No provision for expansion.
1,048	Clan Macnab	1897	Cast-iron stop valve chest burst attributed to water in pipes.
1,049	Swansea	1897	Copper main steam pipe broke flange. Had previously failed same place and had been repaired. No provision for expansion.
1,056	Duchess of York	1897	Copper main steam pipe burst; attributed to water in pipes.
1,057	Thornhill	1897	Copper main steam pipe broke at flange. Had previously been renewed. Want of sufficient provision for expansion.

1,069	Eveline	1897	Three copper main steam pipes broke at flanges in this vessel at different times. No expansion joints are fitted.
1,072	Vienna	1897	Cast-iron junction chest broke at flange; attributed to water in pipes.
1,073	Suningdale	1897	Copper main steam pipe broke at flange. Two previous failures. No provision for expansion.
1,095	Burma	1898	Copper main steam pipe broke at flange; due to insufficient provision for expansion.
1,109	Amsterdam	1898	Cast-iron valve chest burst; attributed to water in pipe.
1,110	Vedra	1898	Copper main steam pipe burst at seam, which was thought to have been originally defective.
1,111	Lobelia	1898	Copper main steam pipes broke at flanges on three occasions. Insufficient provision for expansion,
1,113	Marie Roze	1898	Copper main steam pipe broke at flange; attributed to expansion joint being inoperative.
1,119	Eastry	1898	Copper main steam pipe broke at flange; attributed to insufficient provision for expansion,
1,123	Scottish Hero	1898	Cast-iron valve chest burst, through original defects.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent).

The Moravia.

IN common with most of those who write on shipping matters, I fell into an error with regard to this vessel, both as to her name and as to her ownership. This I hasten to correct. For on her last voyage she was no longer a Hamburg American Liner, no longer even the *Moravia*. At the commencement of the year her original owners disposed of her to the well-known firm of Messrs. R. Sloman & Co., of Hamburg, and they had just renamed her the *Palma*.

Unfortunately the fears which I expressed as to her safety were only too well founded. She struck, in the tempestuous weather then prevailing, on the North Eastern bar of the fatal Sable Island on the 12th February, and almost immediately went to pieces. The first reports of the disaster were brought *via* Gloucester, Massachusetts, by a fishing vessel, and they seemed to indicate that her crew had lost their lives with the wreck. Happily it turned out that this was not the case. Though the vessel lay 12 miles off the shore the Sable Island lifeboat managed to take off the crew, though they endured very great hardships from cold and exposure, sufficient in the case of the second officer, who had been injured by a sea, at the time of stranding, to cause even fatal results. The ill-fated vessel was about sixteen years old, and was built on the Clyde by Messrs. A. & J. Inglis.

Missing Steamers.

Every recent instalment of these notes has had references to the terrible disasters which have characterised the winter season of 1898-9. The present notes contain the most serious of all. Few of my readers will escape having lost friends in the vessels included in the melancholy table which I here set forth. It includes eleven vessels, all of which are hopelessly overdue.

It will be observed that all of them are modern and well-equipped steamships, and it is to be remarked that of none has any trace up to the time of writing been found.

A few remarks about some individual ships may not be out of place. One would be led to believe that the *Almida*, first in the list, was overwhelmed by an earlier hurricane than the rest, but that a later gale was accountable for the loss of ten steamers, besides the serious damages to other vessels which have already been reported. The *Almida* was formerly the *Cedardene*, and it will be noticed that she is the only vessel in the list which was bound west at the time of her loss.

The *Laughton* was formerly known as the *Noord Braband*, whilst the *Arona* had recently had her name changed from *Lambert's Point*. The *Alleghany* and the *Minister Maybach* were tank steamers. The former of them, though her career was short, had had some strange adventures. She was the vessel which was sunk in the Delaware some five years ago by collision with the Belgian steamship *Caucase*, whereby her cargo of over a million gallons of oil was set alight as it came to the surface. The crew thereby had a somewhat narrow escape. The wreck was guarded by a watch boat. But owing to some alleged default on the part of the watchers the Allan steamship *Siberian* ran over her and vastly increased the damage she had sustained. After immense and long-continued efforts the wreck was righted, raised, and taken to Messrs. Cramp's yard. There it was sold. The purchaser took it to New Jersey and had the ship rebuilt and placed on the American register. I think this was her first trip in her new guise.

The largest of the vessels in the list is the fine steamer *Port Melbourne*, of the Anglo-Australian line. She was under charter to the National Steamship Company at the time of her loss.

On the 7th March no less than nine of these vessels were at the same time quoted as uninsurable. Such a sweeping away of steamships and their crews is unprecedented, and it is much to be prayed that the melancholy record may not only never be broken but never even approached in the future. It is somewhat instructive perhaps to notice that all the vessels in the list were Western Ocean ships and that none of them were going out in ballast.

The Bulgaria,

I am pleased to say, was reported safe at the Azores the very day after my last notes went to press. Somehow or other her engineers managed, when the weather improved a little, to mend the apparently irreparable steering gear, and after a friendly tow by the West India & Pacific Company's new steamship *Antillean*, she was able to do her 10 knots into port. Great praise and much honour—especially from the Kaiser—has been, no doubt very properly, showered upon Captain Schmidt, who had all the responsibility of this trying time. But surely the engineering staff, who kept the pumps going, and who devised and executed the repairs, have some substantial claims to honour and to reward.

The Pavonia.

In view of the fact that there will probably be an inquiry into the circumstances attending the serious damage to the steamship *Pavonia*, it is premature to make comments upon the causes of her accident. But it is interesting to note that her experience is not altogether an unprecedented one. There

	Steamers.	Date of build.	Place of construction.	Builders.	Tons gross.	From.	For.	Date of sailing.	No. of crew.	Chief Engin
1	Almida	1886	Sunderland	Bartram, Hassell & Co.	2408	Hamburg	New York	15 Dec., 1898	23	William Mo
2	Picton	1887	West Hartlepool.	E. Withey & Co	2317	Newport News	Sligo	20 Jan., 1899	23	
3	Laughton	1882	Middlesbrough	R. Dixon & Co	2436	Newport News	Copenhagen	23 Jan., 1899	26	T. S. Clark.
4	Minister Maybach	1887	Newcastle	Armstrong, Mitchell & Co.	2710	New York	Flushing	25 Jan., 1899	32	
5	Port Melbourne	1892	Newcastle	Hawthorne, Leslie & Co.	4670	New York	London	27 Jan., 1899	52	C. Rowell.
6	Croft	1891	Blyth	Blyth Shipbuilding Co.	3675	New York	Leith	26 Jan., 1899	27	E. Ryles.
7	Dora Foster	1889	Newcastle	Tyne Shipbuilding Co.	2473	Savannah	Liverpool	23 Jan., 1899	24	F. Kemp.
8	City of Wakefield	1891	Stockton	R. Ropner	3004	Norfolk, Virginia	Rotterdam	23 Jan., 1899	28	W. A. Moore.
9	Allegheny	1890	Stockton	Craig, Taylor & Co	2914	Halifax	Dover	24 Jan., 1899		
10	Oberon	1890	Sunderland	Bartram, Hassell & Co.	2728	Baltimore	London	25 Jan., 1899	29	F. Kendall
11	Arona	1894	Sunderland	J. L. Thompson	3328	Portland, Maine.	London	27 Jan., 1899	36	

was, three years ago, a somewhat similar mishap in the Pacific Ocean to a steamship, the *Bonnington*, which became, as far as could be seen, hopelessly overdue, and yet turned up, though her condition was such that she had to be treated as a constructive total loss. An actual total loss, however, she was not, for after a sale she was repaired, and is now, I believe, under another name, doing good work for a Japanese firm. To Captain Atkin, the master; to Mr. Duncan, the chief engineer, and to their respective staffs the greatest praise is due. It is much to be hoped that as warm recognition of their resourceful pluck will be forthcoming in England, as was so promptly meted out by the German Emperor to the heroes of the *Bulgaria*. But I venture to think that all their efforts would have been unavailing had the ship not been fitted with a donkey-boiler on an upper deck. Thanks to its existence the holds were cleared. Hand pumping alone might have been unable to manage the heavy task. Time after time we have seen the advantage of these installations, and I trust this phase of the accident will not be lost sight of, now that she is safely docked at Liverpool.

Messrs. Harland & Wolff

will be busy enough with repairs. On the 17th of March there reached their yard the s.s. *Germanic*, to be thoroughly cleaned up and overhauled after her unpleasant experience at New York. That there is little the matter with hull or machinery is sufficiently evidenced by the rapidity of her passage to Queenstown in spite of the prevailing heavy weather.

The day after she arrived at her builders' yard, the

P. & O. China

came in there. She has made a much more deliberate passage home, a speed of seven knots having been the maximum considered safe for her even in the land-locked waters of the Mediterranean Sea. This is scarcely to be wondered at, since the repairs which were effected at Perim, though they necessarily occupied a long time in execution, were simply of a temporary character. Her under-water wounds were stopped by a make-shift wooden shield backed and strengthened by the working in of some 1,200 tons of concrete. It will therefore be some time ere we learn what her owners propose to do with her.

The re-hearing of the inquiry into the causes of her stranding was not a long affair, though a large array of counsel were engaged on it. It having been abundantly shown that the constitution of the Court at Aden (which in the first instance tried the case) was not in accordance with law; it having further censured the acting second officer—Mr. Crawford—without affording him any opportunity for defending himself, the case really resolved itself into an inquiry as to whether or not the censure should be repeated by the Divisional Court which conducted the re-hearing. It was, however, proved that the officer in question carried out the orders given him by the master, who was himself on the bridge the last fifty minutes before the vessel struck, whilst Mr. Crawford had been off duty twenty minutes before the catastrophe. Under these circumstances the Attorney-General, who appeared for the Board of Trade, declined to formulate any charge against the acting second officer, and the Court therefore intimated that it was unnecessary for his counsel to address them. The object of those who insisted on the necessity of a re-trial of the case has thus been attained, and the insistence was fully justified.

The Cunard Company

have made a sweep of old ships indeed. Since I last wrote the *Bothnia* and *Scythia*—who have on previous occasions been reported sold—have really been disposed of. One has gone to Spain and the other to Italy. Owing to the high value of copper at the moment, the old favourites realised a price approximating 50s. a ton. The pair of sisters which now disappear were constructed a quarter of a century ago for their owners' New York mail line. It is long since either of them went to New York, however, with the exception of one visit last year paid by the *Scythia*, when she took an extra turn for the *Aurania*, broken down. Their chief employment in the long intervals of leisure has been the Boston line. There they were of little value, as their coal consumption was high—owing to the fact that they had their original compound engines—and their cargo capacity was limited, their design, naturally old-fashioned by modern standards, having been more for the passenger than for the freight trade. Their departure relieves the Cunard Fleet of some 9,000 tons of useless shipping, and makes, as has been pointed out by the *Shipping Gazette*, a total now of no less than 11 old bottoms disposed of in the last two or three years. All of them have gone to the scrap heap.

A Curious Error

on the part of a usually excellently informed shipping paper may be noted. The paper in question is French. But its information is generally as accurate as that of any of its British contemporaries. It is true that in making the mistake it was, in fact, endorsing the erroneous statement of another journal. Some one, it appears, had been noticing the circumstance that two old vessels of the Transatlantique Company were still at work as sailing vessels, one under the British, the other under the German flag. The writer of the paragraph I refer to felt that in some way a reflection was thus cast upon French honour. So it proceeded to show that the French were not alone in having old vessels at work. Naturally enough, they cited the jubilee *British Queen* of the Cunard Line, whose disappearance had not then become known. But not content with crediting her with her actual 50 winters, they added another 10 to her age, and confused her with the 2,000-ton ocean liner *British Queen*, which was the sister ship to the ill-fated *President* of the early days of Transatlantic navigation. In the same way they took the fleet-list of the West India Royal Mail and seeing, correctly enough, the names *Trent* and *Dee* amongst the vessels there, promptly concluded that they were the original owners of those names. The first bearers of the name in the fleet were of course wooden paddle vessels, and if now afloat would be nearly 60 years old. But they have both passed away more than a generation ago, and the *Trent* and *Dee* that now appear are screw steamers built of iron in the seventies.

Disasters

after the storm fog. The opening of the year saw heavy weather and powerful steamers overwhelmed in mid ocean. Then came the loss of the Dominion Liner *Labrador* on the Mackenzie Rock, fortunately without loss of life. An inquiry will, of course, be held, and we need not now say anything as to how she got where she did. But the manner in which passengers and crew were put ashore reflects great credit on Dominion Line discipline. The vessel is, of course, broken up, and the bulk of her mails are gone. She was a fine steamer, the finest up to the date of her launch that was built for the Canadian trade. She was constructed at Queen's Island, and very soon after her coming out in 1892, secured the record between Liverpool and the S. Lawrence for the mail service. She was the last of the single-screw ships which her line have built.

The loss of the *Castilian* came as rather a shock to those who had but a few days before been reading the account of the fine new 8,000-ton vessel which the Allan Line had put on to begin its improved mail service—a vessel which it was said had every appliance which modern experience and ingenuity could suggest for safety and safe navigation. Special attention was called to the wooden after-mast which Messrs. Allan's had fitted to her as to their previous vessels, so that one compass at least, mounted thereupon, might be perfectly reliable and free from all influence of metal. Here too there was fortunately no loss of life though the destruction of property was very considerable.

From the reports now to hand as to the prevalence of ice in northern latitudes, I cannot help fearing that we are not past the disasters of 1899. There is likely to be an unprecedented amount of ice when the iceberg season comes, and it may be expected that unusual caution in navigating the Atlantic will need to be exercised.

The South Eastern & London, Chatham & Dover Railways

have been very fortunate in obtaining the Queen as a passenger for one of their vessels across the channel. They seem confident enough of Parliamentary sanction to their union. For they have added to the joint fleet two new vessels during the last few weeks. One of these was the paddler *Mabel Grace*, built for the passenger service by Messrs Laird's, who seem to have obtained their custom since the Thames yards, to whom they were so long faithful, gave up the business, the last new paddler of the South Eastern, the *Princess of Wales*, having also come from Birkenhead. The other is a screw of smaller size for the cargo service. She came from Messrs. Denny, who had not previously had an order from this quarter.

The Canadian Steamship Company.

Trouble seems to be piled on trouble with regard to the new service of this line. The *Gaspesia*—as I noted last month—was frozen up in the S. Lawrence for weeks, and is not yet able to resume her sailings to the westward; this owing to the unprecedented ice of the present winter. Her March sailing is being taken by the 2,600ton *Dorset*, a vessel of some eighteen years old, built at Sunderland. Of the two steamships *Werra* and *Fulda*, which it was about to acquire from the Nord Deutscher Lloyd, the *Fulda* has been lost to it through the unaccountable accident which befell her in the graving dock at Birkenhead what time she was dry docked for the usual bottom sighting, which is one of the conditions precedent to purchase of steamers. The vessel was so damaged as to be condemned as a constructive total loss. In consequence of this she was sold by auction. The advertisement of the sale contained one curious item. Her dimensions, age, builders, engines, &c., were set out as usual. But the information that she had "condensers" was also afforded, as though in this she was especially well found. In the early days of steamers with compound engines it was not unusual to say that a vessel had "surface condensers," because the surface condenser was of comparatively late general adoption at that time. It was desired to show that the then modern form of condenser was fitted in lieu of the older jet condenser. But the appliance of one form or another have been with us so long that it seemed as necessary to tell us that she had them as part of her equipment as to mention that she had a bow or a stern. The ship was knocked down for £11,500, and was bought, it is said, on account of German owners who intend to refit her for service.

The Financing of Steamship Companies

has occupied a good deal of attention lately. This is no doubt due not only to the activity which is now prevailing in shipping circles, but also to the demand for larger, and therefore for more expensive, vessels. The P. & O. Company is applying to the Privy Council for a supplementary charter to enable it to issue debentures to an amount not to exceed a million sterling, if it considers it expedient to do so.

The Nederland American Company

is so pleased with the big twin-screw steamers *Statendam* and *Rotterdam*, which it has had built at Belfast, that it has ordered three more, to be called *Noordam*, *Potsdam*, and *Rijndam*. The accession of these vessels will enable it to maintain a weekly service of first-class new twin-screw boats which will certainly make their competition felt by other Continental lines. The company seems now to be in a thoroughly sound and prosperous condition. It is about to raise additional capital to the extent of a quarter of a million sterling. This course is rendered necessary in order to provide for the cost of the new steamers it has ordered.

The well-known firm of Houlder Brothers, which has the management of ten large steamships registered in the names of as many single ship companies, is converting itself into a limited company which shall own the fleet. The name of the new concern will be the Houlder Line, Limited, and its capital will be half a million sterling, nearly equally divided into ordinary and preference shares, with power to raise £200,000 in debentures. The fleet comprises some 43,705 tons of modern shipping, of which less than five thousand tons is more than five years old. All the vessels are fitted with installations for carrying frozen meat—a trade in which, as well from the River Plate as from New Zealand, the line has for long held a prominent place.

The West Hartlepool Steam Navigation Company, Limited, has about the same amount of capital as the Houlder Line. It acquires some twenty one steamers, ranging from the *Askehall* and the *Birkehall* of 7,000 tons each, down to the *German Empire* of 780 tons. It amalgamates the business of the West Hartlepool Steam Navigation Company with that of Messrs. J. E. Guthe. Four of its largest steamers, though provided for, are not yet delivered, and it will have the advantage of being under the direction of Sir Christopher Furness.

Messrs C. W. Kellock & Co.,

the reputation of whose firm is seen by the weight attached to their certificates of valuations in the prospectuses of the Houlder and West Hartlepool companies, have the business of disposing of the famous Bazin roller boat. She will be offered for auction by them on April 6th, and a full description of her appears in their list. The deck or platform of the vessel is 126 ft. 6 in, long, by about 40 ft. beam. The toughened steel rollers or discs upon which she runs are each of 32 ft. diameter. There is a water-tube boiler which is capable of supplying steam to engines of 500 H.P. The main engines are of the compound type, and, in addition, the rollers have their separate engines. It is said that when this strange craft was towed across the Channel from her port of equipment to Hull, she behaved splendidly. Intending purchasers are reminded of her possibilities as a raree show and as an advertising medium. But failing that, it is suggested that she would be valuable to shipbreakers as she contains much copper—now at so high a price. Indeed, it is rather cruelly suggested that the platform would make a bridge, whilst the rollers could be used for gas buoys or *caissons*. One will be curious to see what her ultimate fate may be.

The Barquentine "Cavan,"

recently converted at Londonderry from a paddler of the City of Dublin Steam Packet Company, is also on the market. She seems to have been practically rebuilt since she left the cross-Channel service

Messrs. Elder, Dempster & Co.

have been managing grandly for the African Steamship Company. Its tonnage is now a very small fraction under 95,000 tons. It pays a good dividend, and seems to be doing very well for its employees, for whom, as a somewhat hostile question in the House of Commons has just announced to the public, it has inaugurated an arrangement whereby its seamen and firemen, sailing to the not too salubrious West Coast of Africa, can, at reduced rates, make provision with well-known insurance companies for their wives and families in case they succumb to the climate or perils of the sea. It is worth noticing here that for their African service itself, Messrs. Elder, Dempster, who have long believed in it for the Atlantic voyage, are now adopting the twin-screw principle.

They are rapidly preparing to revive the old Beaver Line with fine new steamers, which are now constructing for them on the east coast. These vessels will also be of the twin-screw type, and will bear the names, "*Lake* ——," as did the vessels of the old Canada Shipping Company, whose goodwill Mr. A. L. Jones has purchased from the liquidator of the old line.

The Cape Mails.

The award has not yet been made by the Postal authorities of the new Cape mail contract. There is a story in circulation that a syndicate with a capital of £3,000,000 sterling has sent in a tender offering to reduce the contract time for the mails to Capetown to 14 days. The present period allowed is 19 days, though, of course, the limit is seldom approached. If there be truth in the rumour, there are likely to be very stirring times in this direction, as the old well-established companies—rich and popular as they are—will not let their position be assailed without a very stern resistance.

The P. & O. Company

are deprived of an old servant by the condemnation and sale of their old steamship *Brindisi*, which sustained serious damage some months ago at Bakan, Shimonoseki, in Japan, by collision with the native steamer *Tayeyama Maru*. The *Brindisi* is, fortunately for her owners, one of the smaller and older vessels of the line. But for local trading her size was a very useful one.

M. Paul Fanet.

I very much regret to announce the death of the charming and agreeable agent in England of La Compagnie Générale Transatlantique. M. Paul Fanet, who was liked and respected by all who had ever been thrown in contact with him, died but the other day at Boulogne at an age which was much less than his appearance would have led one to imagine he had attained. His life was shortened by the effects of two serious wounds, one in the shoulder and the other in the knee, which he had sustained nearly 30 years ago when fighting his country's battles in the Franco-German war. The compagnie will have difficulty in finding a man so thoroughly suited for the position as was their late agent in this country.

Richard Melhuish, Sons & Co.—We have recently received a copy of the latest edition of the Engineers' section of the Catalogue issued by Messrs. Richard Melhuish, Sons & Co., and which has just been published. This catalogue has again been revised up to date, and contains a very large selection of the latest patterns of stocks and dies, cutters, general machine shop and special precision tools, lathes, drilling and milling machines, and a variety of other apparatus and supplies incidental to all grades of engineering and contractors' work. This book contains over 300 pages, and is profusely illustrated with an extremely useful set of blocks. It is got up in very good style with stiff covers, and should therefore prove a handsome addition to a library of similar books.

THE BALANCING OF ENGINES.

IT will no doubt, we think, be interesting generally to many of our readers to give some information as to the balancing of engines as carried out under the Yarrow-Schlick-Tweedy system of balancing, particularly as we have been asked by some of our correspondents for information on the subject.

Although much has been done for years past in the balancing of the rotating elements by revolving counterweights usually carried by the cranks, still the increase of piston speed brought into prominence the unbalanced reciprocating elements, which was evidenced by the excessive vibration set-up thereby.

In the case of engines in which two or more cylinders are disposed with their axes in or substantially in one plane, these elements engender forces that act injuriously upon the support or foundation of the engines, as well as on the engine itself, in that they not only tend to displace the engine on its support in the direction of the piston rods, but also in a direction at right-angles, or substantially so, the tendency of which is to alternately tilt the whole engine from the ends of the driving shaft.

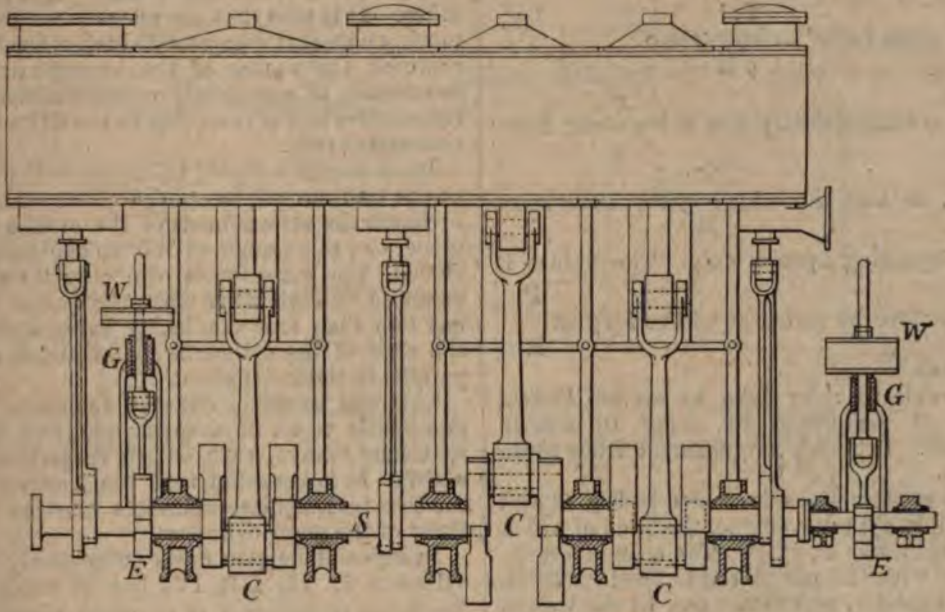


Fig. 1.

In 1892 Mr. Yarrow designed a balancing device consisting of reciprocating weights operated by the shaft, and adapted to counterbalance these injurious forces. He described and illustrated his system by a paper that was read and models which were exhibited in motion at a meeting of the Institution of Naval Architects in April, 1892. This system is substantially shown in Fig. 1 of the adjoining illustration, which represents a three-cylinder triple-expansion engine, the cranks C of which are set at angles of 120° to one another upon the shaft S. At the ends of the shaft eccentrics E are provided, each of which drives a reciprocating rod, carrying a weight W, the rod being guided in a suitable guide G.

The position of the eccentrics on the shaft, and the weight and travel and position of the weights in the direction of the axis of the shaft are so arranged that these reciprocating weights W counterbalance the usual unbalanced forces set up in the direction of the motion of the piston rods. The result of these arrangements was very conclusively shown by a model mounted freely on spring supports, and operated first without the reciprocating weights, and afterwards with them. In the first instance the engine, when operated, danced about merrily, and in the second instance, remained practically stationary. The valves and their gear are, of course, included in the calculations in estimating the weight, travel, and position of the balance weight.

Following on this method, Mr. Schlick in 1894 invented a method of balancing engines which have four or more cylinders arranged in one plane, so as to do without additional balance weights, by utilising the moving masses of rods and the like which already form part of the engine.

Mr. Schlick has estimated that in some marine engines of from 6,000 to 7,000 horse-power, two balance weights, each of from 20 to 30 tons are necessary, which involves a serious addition of weight to the machinery. The invention of Mr. Schlick consists essentially in the proper relative length of the crank arms, in the proper relation of the cylinder centres, and in the proper distribution of the weights of the moving masses so that the latter will act upon the crank shaft in such a manner that the resultant of the forces exerted by the moving masses in one direction upon the crank shaft, namely in the direction of the piston rods, and the resultant of the forces acting upon the shaft in the opposite direction, will be substantially equal and lie in the same straight line.

In the description of his invention Mr. Schlick has used the term "mass-force" to indicate the force engendered by the movement of a weight P in the direction of the piston rods, that tends to displace the engine in that direction, and he defines it in the following formula, viz.:—

$$\text{Mass force} = F \cos \varphi,$$

in which F indicates the centrifugal force of the reciprocating masses, if these forces were concentrated in the crank pin, and φ the angle formed by the crank and the direction of motion of the piston rod, as shown in Fig. 1*. The value $F \cos \varphi$ represents therefore the force that tends to displace the engine in the direction of motion of the piston rod when the crank is in the position making the angle φ with the piston rod. Further if v represents the constant velocity at which the crank pin revolves, R the radius of the crank, and g the acceleration of gravity, then,

$$F = \frac{P v^2}{g R} \text{ or}$$

$$\text{“mass force”} = \frac{P v^2}{g R} \cos \varphi.$$

At a uniform rotary velocity the value $\frac{\varphi^2}{g}$ is, however constant, as also the value $\frac{P}{R}$; the mass-force is therefore depending upon φ only. The values P and R can therefore be varied at will so long as $\frac{P}{R}$ remains constant.

It may be well to refer here to certain known arrangements of balancing in order to clearly differentiate Mr. Schlick's arrangement from those already known.

One of these constructions is shown in Fig. 2, and represents a triple cylinder engine, the rods of which are connected to cranks k^1, k^2, k^3. The central crank, k^2, is connected with the piston rod of the intermediate or central cylinder, and acted upon by the weight 2 L of the moving elements. This crank is in the same plane as the cranks k^1 and k^3, which are connected with the piston rods of the outer cylinders, and each is acted upon by a weight L. If it is assumed that the distance between the cylinders and the lengths of the crank's arms are equal, the forces referred to above are fully compensated or counterbalanced, and there will be neither unbalanced pressure due to momentum in the direction of motion of the piston rods, nor in a direction at right angles thereto, aside from the slight error due to the finite length of the connecting rods.

The same conditions exist in such an engine as shown in Fig. 3, which has two cylinders whose axes lie in exactly the same line, and whose moveable elements are of exactly the same weight. The piston rod of the upper cylinder is connected by a cross head and rods with two cranks, and the rod of the lower cylinder is connected with a crank intermediate of and opposite to the others.

In the two cases first described, we have two groups of moving elements which act with equal mass-forces upon two sets of cranks, and the relative arrangement of the cranks on the crank shaft is obviously 180° to one another. Turning now to the case of a twin cylinder engine connected with two cranks on a crank shaft, as shown in Fig. 4, it will be seen that the conditions are different, notwithstanding the fact that the mass-forces acting upon the said shaft are equal, and the cranks are set in the same plane, only the mass-forces exerted in the direction of motion of the moving elements counterbalance each other, while the couple of forces acting in the direction of the plane of the piston rods can in this construction nearly be balanced. This force may be reduced or diminished by a proper reduction of the distances between the cylinder centres, but the tilting movement of force cannot be eliminated.

A similar case exists where two such twin engines are connected to a single crank shaft or converted into a quadruplex cylinder engine, as in Fig. 5, so long as the two pairs of cranks are set at right angles to each other. It is true that the mass-forces exerted by the moving elements compensate each other in a measure, however the nature of the arrangement renders it impossible to completely counterbalance the forces, irrespective of the error due to the finite length of the connecting rods.

In an engine adapted to be started, whatever may be the position of the cranks on the crank shaft, and in which the arrangement of the cranks in the same plane, *i.e.*, at an angle of 180° to one another, is precluded, the mass-forces can only then be counterbalanced by each other when the power is applied to not less than four cranks, it being understood that the axes of the cylinders are arranged substantially parallel in the same plane.

This will be made clear by reference to the diagrammatic views of a quadruple and triple engine with four cranks, each shown respectively in Figs 6 and 7. It is essential that the moving elements of the two intermediate cylinders must be heavier than those of the outer cylinders.

In Fig. 6 the steam flows successively through the cylinders I, II, III, IV, but in order to shorten the steam passages, it is in many cases advisable to reverse the relative position of the cylinders III and IV. The triple-expansion engine shown in Fig. 7 has two low-pressure cylinders III. Dealing now with the quadruple expansion engine shown in Fig. 6, as an example, we will assume that the weights of the moving elements of the cylinders III and IV are represented by *p*III, and *p*IV, respectively, and that the angle between the two cranks is known, which for the sake of simplicity may be assumed to be 90°; and if further it is assumed that the distance between the axis of proximate cylinder is equal and all the crank arms are of the same length, the method of finding the weights of the moving elements of cylinders I, and II, and the relative angle of the cranks to which the pistons of those cylinders are connected, are as follows:—

In order to compensate the mass-forces exerted by the moving elements of cylinder IV by the mass-forces exerted by the same elements of cylinders I and II, it is necessary to provide for the last two cylinders cranks of equal length that lie diametrically opposite the crank of cylinder IV. The force exerted upon the crank shaft by the moving elements of cylinder II will, however, be greater than the force exerted upon the shaft by the moving elements of cylinder I, in proportion as the distance is between the centres of cylinders II and IV. is smaller than that between the cylinders IV and I; the sum of the forces acting upon the cranks of the cylinders I and II, should, however, be equal to the force exerted upon the crank of cylinder IV, accordingly a force equal to $\frac{1}{3}p$IV, and $\frac{2}{3}p$IV, respectively, should be exerted upon the crank shaft by the moving elements of the cylinders I and II, relatively to the force exerted by the like elements of cylinder IV. In a precisely similar

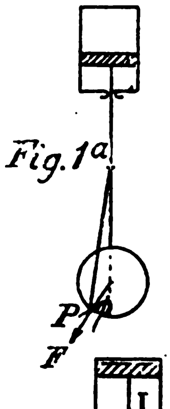


Fig. 1a.

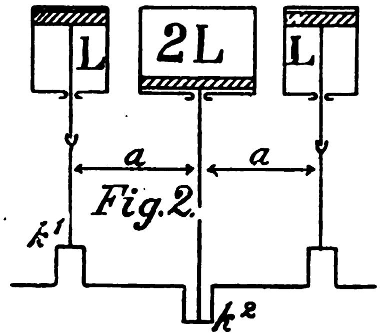


Fig. 2.
L
2L
L
a
a
k¹
k²

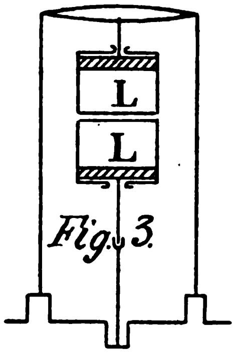


Fig. 3.

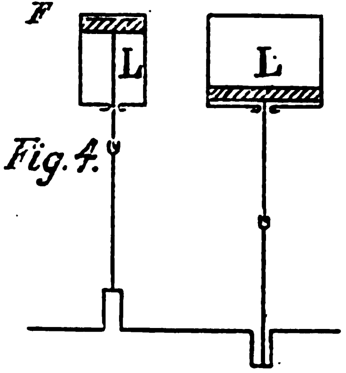


Fig. 4.

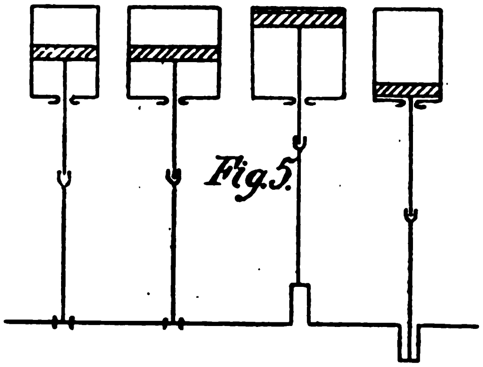


Fig. 5.

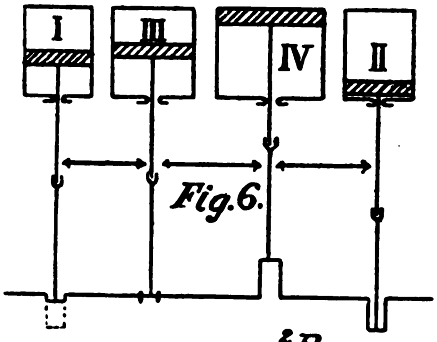


Fig. 6.

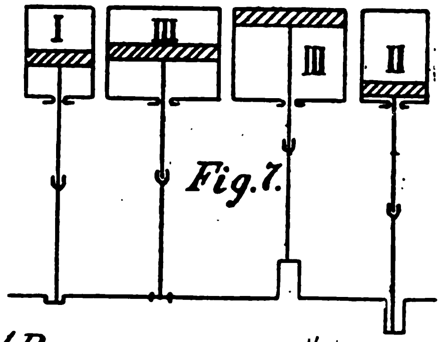


Fig. 7.

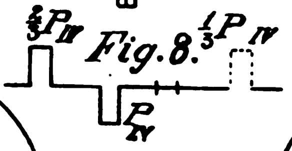


Fig. 8.
⅔P IV
⅓P IV
P IV

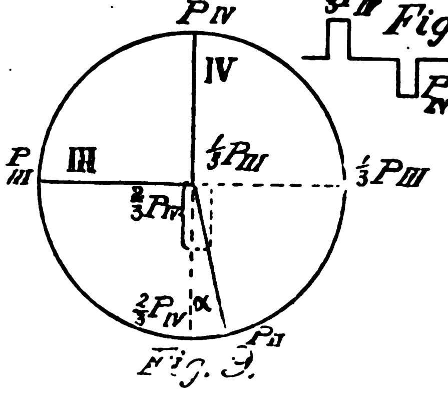


Fig. 9.
P IV
IV
P III
III
⅓P III
⅓P III
⅔P IV
⅔P IV
α
P II

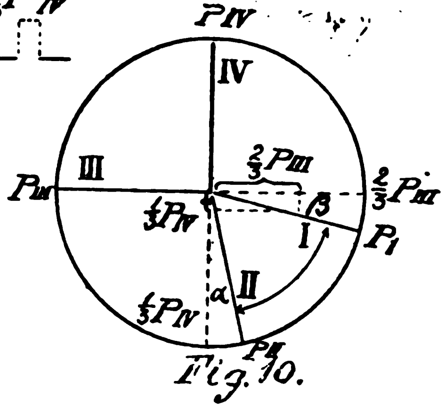


Fig. 10.
P IV
IV
III
P III
⅔P III
⅔P III
⅓P IV
β
I
P I
⅓P IV
α
II
P II

manner, the force exerted upon the crank shaft by the moving elements of cylinder III, that will counterbalance the forces exerted by the moving elements of cylinders I and II may be determined, viz. :—weights equal to $\frac{2}{3}p\text{III}$, and $\frac{1}{3}p\text{III}$, respectively, will have to act upon the cranks of cylinders I and II, in order to compensate the force exerted upon the crank shaft by the weight of the moving elements of cylinder III, as shown in Fig. 8, in which case the cranks I and II would have to be arranged diametrically opposite the crank of cylinders III.

If the relations that occur in the circle of the crank for the cylinder II., as shown in Fig. 9, are considered, it will be found that there should be exactly opposite the crank of cylinder III a crank upon which a force of $\frac{1}{3}p\text{III}$ is exerted; and at the same time there should be opposite the crank of cylinder IV a crank upon which a force equal to $\frac{2}{3}p\text{IV}$ is exerted.

In view of the fact that it is not possible to arrange two cranks at the same time in one plane, a single crank must be substituted therefore, the position of which, as well as the force acting thereon, will be determined by the resultant of the weights that would have acted on the two cranks. Hence if the value $\frac{1}{3}p\text{III}$ is carried according to a certain scale, to a prolongation of the crank-arm of cylinder III, and similarly the value $\frac{2}{3}p\text{IV}$ to a prolongation of the crank-arm of cylinder IV, the direction or position of the single crank for the cylinder II, and the weight that should act thereon, can be directly deduced from the parallelogram of forces. The position of, and the weight that should act upon, the crank for the cylinder I are obtained in the same manner.

If, therefore, it is assumed that the angle formed by the cranks of cylinders III and IV as shown in Figs. 9 and 10 is one of 90°, the following formulæ will result :—

$$p\text{I} = \sqrt{(\tfrac{2}{3}\,p\text{III})^2 + (\tfrac{1}{3}\,p\text{IV})^2}$$

$$p\text{II} = \sqrt{(\tfrac{2}{3}\,p\text{IV})^2 + (\tfrac{1}{3}\,p\text{III})^2}$$

$$\text{Tang}\ \alpha = \frac{\frac{1}{3}\,p\text{III}}{\frac{2}{3}\,p\text{IV}} = \frac{p\text{III}}{2\,p\text{IV}}$$

$$\text{Tang}\ \text{B} = \frac{p\text{IV}}{2\quad\text{II}}$$

α and B being the angles which the cranks II and I make respectively with the cranks IV and III produced.

Formulæ are given for the conditions of the cranks of cylinders III and IV, not being a right-angle, and of the weights acting on and angles of the outer cranks being known, but they are too lengthy to be given in this article. It will be understood that in making the final calculations the valves, pumps, and their gear are taken into consideration, and in the case of three-cylinder engines it is suggested that the balance can be effected by using a reciprocating weight in place of the fourth cylinder.

In 1895 Mr. Tweedy made some further addition to the mathematical treatment of the subject in the matter of engines which have four or more cylinders, the axes of which are not in the same plane, and in which other conditions obtain, forming improvements on the method invented by Mr. Schlick, which, however, our space will not allow us to give detailed particulars of; they can, however, be readily obtained from the patent specifications.

We think we have given sufficient particulars to enable our readers to gain some general idea of the system composed of the methods invented by these three gentlemen.

NAVAL MATTERS, PAST AND PROSPECTIVE.

(From our own correspondents at home and abroad.)

The Navy Estimates.

THE new navy estimates which the First Lord of the Admiralty presented to Parliament recently show a further increase in the money which he proposes should be spent upon the Navy during the ensuing financial year. This increase represents a sum of £2,816,000 on last year's votes, the total amount of the estimated expenditure being £26,594,000. There is an increase in the personal account of £452,600. The works vote is higher by £145,000, the ordnance vote by £161,600, the shipbuilding vote by £2,016,000, and various miscellaneous votes show an increase of £40,900. The total number of officers, seamen, and boys, coastguard and Royal Marines proposed for 1899-1900 is 110,640, being an increase of 4,250 on the number voted for the financial year just ended. The additions proposed are to meet the larger requirements of the Fleet, and are composed of 463 officers, 1,700 petty officers and seamen, 215 engine-room artificers and artisans, 1,000 stokers, 172 miscellaneous, 500 marines, and 200 boys under training. Steps are being taken to effect a simplification in the rules governing the sea and harbour time of all officers, which have long been felt to be in an unsatisfactory and anomalous condition. The system of granting leave on full pay to certain classes of officers on return from foreign service has been extended, so as to include all commissioned officers below the rank of flag officer, also the warrant officers. A new system has been inaugurated, under which the Admiralty may at their discretion grant sick leave on full pay for a maximum period of three months to officers who become unfit for service at home or abroad from causes beyond their own control. The examination for the entry of engineer students, and the regulations governing the course of training at Keyham College and in the dockyards, have been revised. Additions both in pay and numbers are to be made as regards the Royal Marine corps, and an increase in the number of officers and men in the Royal Naval Reserve is also provided for. As regards the new shipbuilding programme, it is proposed to commence in the dockyards two battleships (design not yet decided), two armoured first-class cruisers, 9,800 tons, three smaller cruisers (design not yet decided), and two sloops. By contract it is proposed to build two first-class torpedo boats to replace others struck off the list. The two sloops to be laid down are to be in their general character similar to the *Phœnix* and *Algerine*. They will be propelled by twin screws, and be of moderate draught suitable for river service.

The Criticism on the Estimates.

From some members of the House of Commons and a few of the daily papers criticism was to be expected, but in the House neither Mr. Labouchere nor Mr. Dillon succeeded in convincing more than a few persons of the necessity for their amendment to reduce the vote for *personnel*. Mr. Dillon in fact made himself ridiculous when he asserted that Mr. Goschen had in view the strengthening of the Fleet to a point superior to that of six great Powers. Sir Ughtred Kay-Shuttleworth also rose with the object of contesting the wisdom or expediency of the proposed extra expenditure, but before he had finished he was practically patting Mr. Goschen on the back. For, said he, it is far more economical to spend money by means of the estimates, which added real strength to the Navy, than under a feeling of alarm to make a sudden spurt, and spend a lot of money obtained by a vote of credit with little or no permanent results. Mr. Gibson Bowles apparently had some misgiving with regard to the new construction, for he seemed to think that we were not maintaining our lead as regards the time taken up in the building of warships. Delay has certainly occurred in the construction of battleships and cruisers since 1897, but this has been in part due to the dispute in the engineering trade, to the re-construction of plant by the manufacturers of armour, and to other circumstances connected with the delivery of guns and machinery. The great excess in the shipbuilding vote over that of last year, £800,000, was determined by four factors, said Mr. Goschen, previous liabilities, provision for the commencement of new ships, provision for repairs, and the necessary provision for coal, sea stores, &c. But however large the increase in the estimates for 1899-1900 may be, it may be taken for granted that the Admiralty would not have recommended it if the political situation in Europe had not called for the strengthening of the British Navy.

Portsmouth Dockyard.

There is to be no lack of work at this yard during the coming financial year, for the vote for new construction and repairs for the ensuing 12 months amounts to £1,195,611. The *Canopus* is to be completed, and the *Formidable* and *London* are to be advanced as rapidly as possible. The second-class cruiser *Gladiator* is to be completed, and the third-class cruiser *Pandora* advanced, while an armoured cruiser and a smaller vessel are to be laid down. Of the money allotted to this yard, £911,249 is to be spent on ships already in hand, £127,517 on the new vessels which are to be commenced, and £151,845 on refits. Some little disappointment has been experienced that so few concessions have been made to the various members of the dockyard. Of the ordinary work at this yard it may be mentioned that the *Gibraltar* is waiting to be taken in hand, and to undergo a thorough overhaul. The torpedo boat *Dasher* has received a new set of boilers, and the *Hasty* has gone to Hull for a similar purpose. The *Charger* and *Havoc* are also to be re-boilered before long. The oil fuel trials in the *Surly* continue, although it has been found practically impossible to do away with the dense volumes of black smoke which are caused by this fuel. Several alterations have been suggested and tried, but very little improvement is apparent. Work on the *Canopus* continues to be as brisk as ever, and the vessel was recently undocked and placed under the sheerlegs, in order to have her heavy weights lifted on board.

Old Names for New Warships.

The names which the Admiralty have selected for the battleships and cruisers of the shipbuilding programme put forward by Mr. Goschen in March and July of last year have met with the approval of nearly everybody, and the Admiralty Board is to be congratulated on its selection. The four battleships will be named after four of our greatest admirals. One, the *Russell*, is to be laid down at Hull; two others, the *Duncan* and *Cornwallis*, are to be laid down at the Thames Ironworks, Blackwall; and the fourth, the *Exmouth*, will be built at Birkenhead. One of the cruisers, to be laid down at Barrow-in-Furness, is to be named the *King Alfred*; two others, to be laid down on the Clyde, the *Africa* and *Leviathan*; and a fourth, to be built at Pembroke, will be named after the great Admiral Drake. Taking the names as they are mentioned here, the first *Russell* was so named in May, 1692, in honour of Admiral Russell, who fought the Battle of Barfleur, and was launched at Portsmouth in the following June. She has a fine record of service, one which would look well on a battle-honour flag. The *Duncan* is, of course, named after Admiral Adam Duncan, and will be the third of her name; the *Cornwallis* will be the fifth of her name, and she has also an excellent war record. The *Exmouth* will be the second of her name, and is named after the dashing Sir Edward Pellew. Of the cruisers, the *Alfred* will be the fourth of her name; the *Africa*, the third of her name; the *Leviathan*, the third of her name; and the *Drake*, the tenth of her name. The name Drake dates back as far as 1652, and all the vessels which have borne the other three names given to the new cruisers have done yeoman service to the country. A writer in one of the weekly service papers, although agreeing that the names are good, suggests those of *Montagu*, *Vanguard*, *Namur*, *Captain*, *Defence*, *Foudroyant*, *Plymouth*, *Monmouth*, *Torbay*, *Prince of Wales*, *Lennox*, *Buckingham*, *Tremendous*, and *Tonnant* as being more or less suitable for ships now building or likely to be built in the future.

Torpedo-boat Destroyers as Queen's Escort.

For the first time on record Her Majesty was escorted across the Channel by a flotilla of torpedo-boat destroyers on the occasion of her leaving for her visit to the South of France. The vessels which accompanied the *Calais-Douvres*, in which vessel Her Majesty made the passage, were the torpedo-boat destroyers *Chamois*, *Ranger*, *Crane*, *Teaser*, *Star*, *Violet*, *Flying Fish* and *Hunter*, commanded by Commander C. Treherne, R.N., and the Trinity Yacht *Irene*. Her Majesty was apparently pleased with her escort, for, just before the *Calais-Douvres* reached her destination, the Queen caused a general message to be made to the flotilla, as follows: "The Queen is very much pleased with the appearance of your flotilla, and wishes to make her appreciation known to the commander and the officers and crews." To this kind and appreciative message came the reply: "Please thank Her Majesty in the name of the officers and crews for her expression of appreciation." Shortly before the flotilla reached the Boulogne breakwater the signal was given for it to return, and a very pretty manœuvre was executed. The two columns of destroyers steamed round almost simultaneously, and in a few minutes had formed in line, and were on their way back to England. Her Majesty expressed her admiration of the handling of the flotilla of destroyers. Directly the boats had left the Queen full-speed trials were started, and in a little more than four hours the first of the destroyers, the *Violet*, had reached Portsmouth. A good deal of credit is due to the commanders and crews of the boats, especially to the officers and men of the engineering department, for the efficient manner in which the flotilla carried out the work of escorting the Queen.

Pembroke Dockyard.

Very little information about the new cruiser to be laid down here has been given out, as her design is as yet uncompleted. It is, however, known that her displacement will be 9,800 tons, and she will be named the *Drake*. The cruiser *Spartiate*, which was launched in October last, is to undergo the completing stages of her construction at Devonport, where she will be permanently attached. This cruiser should be completed for sea by August next. She is what may be termed an improved *Diadem*; all the other vessels of her class are being built in private yards. Her total cost will be about £550,000, but nearly £70,000 of this money will be spent upon her when she reaches Devonport. *Apropos* of the visit of the Duke and Duchess of York, for the purpose of launching the Royal yacht on May 9th next, His Royal Highness has consented to receive an address of welcome from the town council at Pembroke. Work on the Royal yacht continues to make good progress, but she will still be more or less in an incomplete state when she leaves this yard. The name at present given to this vessel is the *Balmoral*, a name which will probably be retained. Although the yacht is to be launched in May, she will not be sent to Portsmouth until October; and it is expected that she will make her first official appearance in the Isle of Wight during the Cowes season of 1901.

The Imperial Japanese Navy.

The work of increasing the navy of Japan goes on as briskly as ever, for during the past month the battleship *Asahi* has been launched at Clydebank, the destroyer *Shiranui* ("Will-o'-the-Wisp") at Chiswick, and the great cruiser *Kasagi* left Portsmouth a few weeks ago *en route* for Japan. As regards the battleship *Asahi*, she is the heaviest ever built by the Clydebank Shipbuilding and Engineering Co., and resembles very closely the *Shikishima*, which was launched on the Thames about five months ago. The principal dimensions of the *Asahi* are:—Extreme length, 425 ft. 6 in.; breadth, 75 ft. $2\frac{1}{2}$ in.; and depth, 43 ft. $7\frac{1}{2}$ in., with a displacement of 15,200 tons on a mean draught of water of 27 ft. 3 in. The armament will comprise four 12-in. breech-loading weapons mounted *en barbette*, fourteen 6-in. quick-firing guns, twenty 12-pounders, and eight 3-pounders; while the hull is pierced for four submerged torpedo tubes. The machinery, which will be supplied by the builders, is in an advanced stage, and consists of two sets of three-cylinder triple-expansion engines, each of which is expected to develop 7,500 H.P. The boilers, twenty-five in number, are of the Belleville type, with economisers, and the vessel will have a bunker capacity of 1,400 tons. The estimated speed is 18·5 knots, and when completed for sea the *Asahi* will be one of the most formidable battleships afloat. The *Kasagi*, which has just left for Japan, was built and engined at Cramp's Yard, Philadelphia, but received her armament at Elswick. One interesting feature about her is the disposition of her guns, which are mounted on the upper deck, forecastle, and poop, four torpedo-tubes only being carried on the maindeck. She has also, on platforms raised above the upper deck, four machine guns, the mechanism of which has been invented by a Japanese officer, but which were manufactured at Elswick. The remaining

Japanese vessel launched, the destroyer *Shiranui*, is one of six 30-knot boats, which the Japanese Government have entered into a contract with Messrs. Thornycroft to build and complete.

Two Notable Launches.

The launch of the first-class battleships *Implacable* and *Glory*, at Devonport and Birkenhead respectively, took place successfully last month. As regards the *Implacable*, she is the largest vessel ever built at Devonport dockyard, and in addition, she established a record for that yard in warship building, since she was laid down, on July 15th last, 5,300 tons of material having been built into her. A description of her has been given in these pages before, but it may be added that she is one of a trio of improved *Majestics*, the other two of which ships are the *Irresistible* and *Formidable*, now completing at Chatham and Portsmouth respectively. The launch was successful in every way, Lady Ernestine Edgecombe performing the launching ceremony. As the *Implacable* glided into the water her proportions in length and breadth, of 400 ft. and 75 ft. respectively, were seen to the best advantage. She has yet to have her masts, boilers, armour plates, &c., fitted into her, and for this purpose was berthed alongside the staff-captain's jetty. The first-class battleship *Glory* was floated out, and having been built in dock she was fitted with all her citadel and casemate armour, and most of the barbette armour, as well as having a considerable portion of the boilers on board, and all the auxiliary machinery in place and pipes and connections fitted. When she took the water she displaced about 9,000 tons. The christening ceremony was performed by Mrs. John Macgregor Laird, wife of the senior member of the builders' firm, and as soon as she entered the river, tugs took her to the Great Float to receive the remainder of her boilers, and be completed for sea. The *Glory* is the third of a series of four large first-class battleships which have been entrusted by the Government to Messrs. Laird to build since 1899.

Chatham Dockyard.

The new work for the coming financial year for this yard includes the completion of the *Goliath* and *Pioneer*. The *Irresistible* and the *Venerable* will be advanced. A new battleship and a new cruiser will also be laid down. The vessels which are to undergo a refit include the *Hood*, *Blenheim*, *Imperieuse*, *Grafton*, *Hawke*, *Immortalite*, *Scylla*, and *Archer*. Thus there will be ample employment for the large staff at this yard for the next twelve months. The bill, by the way, for wages for the last year is well over £5,000. The *Amphitrite* has been here, in order to have her hull surveyed by the officials. She met with a slight accident while entering the basin, running her bows against the caisson, and sustaining some slight damage. A large staff were immediately sent aboard her to prepare her for sea. The new armament for the *Dreadnought* has now been completed by the arrival from Woolwich of the 12·5 in. muzzle loaders. It will be remembered that she is being re-boilered, and her engine power has been increased. Altogether some £30,000 or £40,000 has been spent upon her, and it is a pity, therefore, that she is armed with obsolete muzzle-loading guns, whereas, if a few thousand extra had been spent, she might have carried modern breach-loading guns. The delay in the trials of the *Goliath* is said to be due to the engineering contractors being a little behindhand.

Rifle Practice in the Navy.

The annual return of rifle practice by the petty officers and seamen of the Navy for 1898, recently issued, shows us that although the general results were not so good as those obtained in 1897, the individual results were very good indeed, the highest score being two points above that of the previous year. 11,626 men took part in the firing, and out of this number 1,623 qualified as marksmen. Out of a total of 123 ships, from which complete returns have been received, four only were armed with the old Martini-Henry rifle, the remainder using the Lee-Metford. Petty Officer A. Gloyne of the *Royalist*, proved himself the best shot in the Fleet, as he scored 227 points out of a possible 240. The next best individual shot was F. Stratford, a Gunnery Instructor of the *Orlando*, who scored only two points less than Mr. Gloyne. But the general average was only 134·53, as against 147·78 for the previous year. The ship with the best record is the *Curacoa*, fifty-five of her crew taking part in the competitions, out of which forty-nine scored over 165 points, the average points obtained being 176·4 out of a possible 240. The results from the several squadrons showed that the Particular Service headed the list with an average of 155·99, and the South-east coast of America Squadron comes last on the list with 102·6 average points. As is mentioned above, all but four of the 123 ships which competed were supplied with the Lee-Metford rifle, and the low average is probably in some part due to the fact that the men have only recently been supplied with this weapon. Then again many of the stations at home and abroad have no proper range where practice can be carried out. When this omission is repaired, and the men get used to the steady firing of the Lee-Metford, the standard of rifle shooting should improve throughout the Fleet.

A New Process for Making Armour.

The delay which occurred last year in the manufacture of armour for the Navy will probably be repeated if it is true that Mr. T. A. Edison, a son of the great inventor, has discovered a process which is superior to any now in use. Experiments with a 6-in. plate, treated by this process, proved, it is said, that the plate was superior in resistance to 15-in. Harveyed plates and to plates 12 in. thick treated by the Krupp process. Presuming that special plant will have to be laid down for making armour-plates by Mr. Edison's process, it will be seen at once that the armour-plate manufacturing firms of this country will be obliged to go to an immense expense. This was what happened when the Harvey process took the place of that invented by Mr. Tressider, and also when the Krupp process was found to be superior to that invented by Mr. Harvey. Krupp-process armour, we are told, has only just passed the experimental stage in the United States, and is only being manufactured on a moderate scale by the Carnegie and Bethlehem companies in that country. The qualities of the Krupp armour which have proved it superior to that made by the Harvey process is its depth and hardness of base, extreme toughness of back, and immunity from cracks under numerous heavy impacts. The process of manufacture is not patented, but is a so-called trade secret, though not wholly so. As regards the cost of manufacture but little can be said except by those engaged in the business. The American companies claim that their output is smaller, and that the risks of losses are greater with Krupp than with the ordinary armour. According to all accounts, Krupp armour is in use in England, Russia, Germany, France, and Japan, and it is positively stated that as regards the principal British armour-making establishments they are not selling it to anybody for less than £117 per ton, which is considerably less than that which the American Government have offered the armour-plate manufacturers of that country. From this it will be seen that, if Mr. Edison's invention comes to anything, considerable trouble and expense is in store for the armour-plate manufacturers all over the world.

Sheerness Dockyard.

There is an abundance of work at this yard in all directions, and it is expected that the coming year will be one of great activity as regards the building and completing of vessels. Two new sloops are to be commenced, but they will not be laid down until a few months' time, probably not until after the *Vestal* and *Shearwater* have taken the water. Although the sloops *Condor* and *Rosario* were floated out nearly three months ago, they have not yet got the whole of their machinery on board. Work on the *Vestal* and *Shearwater* is being pushed forward as much as possible, and other work includes the completion of the cruiser *Prometheus*, and the *Basilisk*, sloop; *Speedy*, torpedo gun-boat; *Skipjack*, torpedo gun-boat; and *Goldfinch* and *Sparrow*, gunboats, will be refitted. The *Sanspareil* recently left here for Chatham to have her defects made good. It is expected that she will not be ready for sea until the middle of May. The *Pomone* is now being prepared for the fleet reserve. She will probably be placed on the roster for sea service in the place of the *Perseus*, which vessel was to replace the *Salamander* on the Mediterranean Station. The refit of the *Landrail* has been completed, and she is now ready to resume her duties. The *Onyx* has been placed in dock to undergo a refit, and the old *Wye* is also to be prepared for another trip. She is to leave here on the 8th of this month and goes to Sierra Leone and Ascension.

The French Navy.

The French Navy Estimates, which were presented to the Chamber last month, formed most interesting reading. It appears that the first demand was for 304,078,400fr., but the addition of some 5,000 men to the marine forces, and the expenses likely to be incurred by the navy taking a sufficient part in the coming exhibition increased this estimate by nearly 3,000,000fr. However, the Budget Committee reduced this somewhat, and proposed to the Chamber that a sum of 302,065,994fr. be allotted to the navy. M. De la Porte, in presenting the Estimates to the Chamber, said that France had made extraordinary exertions to increase her navy, and in proof of this, mentioned that in 1872 the Navy Estimates were only 118,000,000fr., but in 1890 they had risen to 201,552,516fr., and this year to more than 302,000,000fr. The outlay upon new construction has jumped from nearly 36,000,000fr. in 1890 to 92,689,000fr. in 1899. Turning to another subject, the French navy is to be condoled with on the disastrous explosion at Lagoubrun, near Toulon. Questioned in the Chamber concerning this affair, M. Lockroy said that the technical and judicial investigations were not yet complete. He was inclined to suggest that brown powder was probably the cause of the disaster, and attached no importance to the packet of dynamite which was found. The *Moniteur de la Flotte* says that there is reason to fear that fulminate of mercury had been stored in the magazines contrary to orders, and that this may have caused, even at a distance, the explosion of dry gun cotton, dynamite, and rapid-burning powders.

The "Brief" for the Engine-Room Artificers.

Seeing that the grievances of the engineer officers of the navy are likely to be ventilated in Parliament, the engine-room artificers have evidently considered the time opportune to offer a few suggestions, which, if carried out, would improve their own position. These suggestions they have issued in the shape of a " brief," as they term it, and their requests are certainly most modest. The regulations for promotion to the rank of warrant officer they would like to see improved, and especially the age qualification, which appears to press unduly upon the younger men. There seems no reason either why their request that the regulation obliging a candidate for promotion to be 35 years of age should be altered cannot be granted, nor that retirement should be at 50 years instead of 55, as is at present the case. Several other points in the " brief " could easily be conceded. If the grievances set forth in this document are all that the engine-room artificers have, it would be easy enough to remove them, but the question always arises as to whether the views of the whole of this class of men are represented.

The American and Swedish Navy Estimates.

The Navy Estimates of both these countries have recently been made public, and as regards the first-named, it is proposed to put 12, and probably 15, ships in hand. The 12 vessels which have been arranged for are three battleships of about 13,500 tons displacement, carrying the heaviest armour and most powerful armament of vessels of their type, to cost, exclusive of armour, 3,600,000 dols. each; three armoured cruisers of about 12,000 tons, to cost 4,000,000 dols. each; six cruisers of about 2,500 tons, of high speed, good cruising qualities, and most powerful ordnance suited to their type, to cost, exclusive of armour, 1,141,800 dols. each. The three vessels not yet decided upon are protected cruisers of 6,500 tons displacement, to cost 2,150,000 dols. each. As regards the navy of Sweden, this is to be increased by two cruisers of 3,300 tons, and Parliament has been asked to grant a supplementary vote of money to be used in modernising three cruisers which have become out of date. The reason that this supplementary vote has been asked for is said to be that Norway will shortly have four armed cruisers at its disposal, all more powerful than the Swedish vessels of the same class.

Devonport Dockyard.

The chief event of the past month at this yard was the launch of the *Implacable* on the 11th. She is the second modern battleship which has been built at this yard, and will be completed by October, 1900. According to Mr. Goschen's statement, in addition to the *Bulwark*, which is now preparing to build, and which it is proposed to complete by June, 1901, we are to have one of the new battleships he referred to, and a third-class cruiser, of which the design is yet to be decided, is also to be laid down during the year. The *Ocean* is to be completed by July 24th next, and the cruisers *Hermes*, *Highflyer*, *Hyacinth*, and *Spartiate* are also to be prepared for sea, as well as several torpedo boat destroyers built in other yards. The *Hecate* has been taken in hand for the purpose of being re-boilered. As regards the *Hermes*, this vessel was to have been delivered in October last, but the dispute in the engineering trade upset calculations a little, and it will now be impossible for her to commission until July next. The lengthening of No. 3 slip, from which the *Implacable* was launched, has been referred to before, but it is worthy of mention that this work has added very much to the dockyard's capacity for battleship construction. The new slip which is to be built on the sites of the two covered sheds at Mutton Cove, known as slips Nos. 1 and 2, is to be considerably longer than the present open slip. The successful issue of the trials of the *Psyche* has proved the worth of the work turned out at Keyham factory, and it is rumoured that more important work will shortly be given out to the factory. She is to be completed by the 28th of this month. The new funnel of the cruiser *Edgar*, which was made by the boiler makers at Keyham, and weighed nearly ten tons, has now been lifted into place. The *Edgar*, it will be remembered, was the cruiser which lost one of her funnels while crossing the Bay of Biscay during the recent bad weather. The *Skate*, torpedo-boat destroyer, which also met with an accident recently, by which she lost the whole of the blades of one propeller and two blades of the other, has now had her injuries attended to. The *Opossum* has also undergone some repairs, and has now resumed her instructional duties.

Experiments with Water-Tube Boilers.

During the debate on the Naval Estimates, Mr. William Allan, the Member for Gateshead, found another opportunity of attacking the Belleville water-tube boiler and especially its use in large vessels like the *Terrible*. *Apropos* of the bursting of a water-tube in that vessel he said that numbers of vessels like the *Terrible* are ruined by boiler explosions, and rendered fit only for scrap iron, and that the men down in the engine-rooms of vessels fitted with this type of boiler were in a state of tension, afraid at every moment lest the boilers should burst. The men in the *Terrible* he declared were panic-stricken. These statements are surely exaggerated; and if Mr. Allan enquired more closely into the matter, he would find out that the boilers were not always the cause of the trouble. The Admiralty, however, continue to pin their faith to water-tube boilers, and recently ordered a series of trials to be carried out on the gunboat *Sheldrake* with the Babcock & Wilcox type. These trials are not yet completed, but when they are the results will be compared with those obtained from the *Sharpshooter*, fitted with Belleville boilers, when she carried out precisely similar trials to those of the *Sheldrake* in 1895. The result of the first trial which the *Sheldrake* carried out was most satisfactory. She had to steam 1,000 miles under ordinary service conditions, indicating 1,500 H.P., using only three-fourths of her boiler power. On the trial in question an average of 1,500·3 H.P. was registered, giving a grate surface of 189 sq. ft., and a heating surface of 6,528 sq. ft. The coal consumption worked out at 12·31 per square foot of the grate surface, and 1·61 per I.H.P. 71 tons 14 cwt. of coal was burnt during the run, and efforts were to be made during the succeeding runs to further reduce the coal consumption. It is noteworthy that the engine-room staff had no previous experience with this boiler. The second trial was completed on the 17th ult., and this trial was eminently satisfactory, especially as regards economy in coal consumption; with the same heating surface and grate area, the power developed was 1,500 H.P., the quantity of coal worked out at 12·67 lbs. per square foot of grate surface per hour, and 1·6 lbs. per I.H.P. per hour. It was remarkable in both these trials that the efficiency of the boilers was better at the end of the run than at the commencement, and apparently they could have continued steaming so long as the coal lasted with the efficiency fully maintained. The third trial commenced on the 27th ult. The boilers fitted in this vessel are of British manufacture, and are made entirely of wrought steel; they are also largely used in the Mercantile Marine, and are giving most satisfactory results. If the remainder of the runs of the *Sheldrake* pass off without a hitch, and the coal consumption continues to be as small in comparison with a number of other types of water-tube boilers, it will augur well for the further adoption of Babcock & Wilcox boilers in the vessels belonging to H.M. Navy.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

THE Institute of Marine Engineers, in their care of, and endeavours to provide a better class of, marine engineers, have scored a victory which will be all the better appreciated because of the long time taken to come to the end aimed for.

Formerly it was possible for a person to put in the three years' service at sea, and in some cases those who had never put in any time as engineers in a shop ashore were allowed to pass the Board of Trade examinations for second class certificates. It came about in this way. Some young man with a friend having an interest in the ship would get appointed as an assistant in the engine room and serve his three years there. These three years were accepted by the Board of Trade as satisfying the required service. And so it came about that men could be in charge of the engines who had never had an engineering training at all. Now this is changed. Every person who presents himself for examination for a second-class certificate of competency must have undergone a thorough training in the engineering shops ashore before he can try for it. The alterations which affect this are as follows:—

"Paragraph 22. Candidates for second class must serve as apprentice engineers for five years instead of three years; three years of the five must be spent in fitting or erecting; no service in drawing or boiler yard will count for more than 12 months; time spent in technical schools may be accepted under certain conditions; all applicants to produce testimonials of ability as an engineer workman. The sea service required cannot be performed in vessels with engines of less than 66 N.H.P. Sea service alone will no longer qualify a candidate for examination."

There is a further regulation bearing on this:—

"8. All applicants will be required to produce, in addition to the official discharge-certificates, testimonials as to their workshop service and as to their service at sea. The testimonials as to workshop service must be signed by the employer, and must testify to the applicant's conduct and ability, and state what kind of work he was engaged on (*e.g.*, fitting, erecting, &c.) and for how long."

Another regulation refers to service at sea:—

"9. Testimonials as to service at sea must testify to the applicant's sobriety, experience, ability, and general good conduct for at least the last twelve months' service at sea preceding the date of application to be examined. They must be signed by the master and chief engineer (or in case of testimonials to chief engineers, by the master and superintending engineer), and must clearly state whether the applicant was on regular watch and in regular charge of a watch, on the main engines or boilers. It is desirable that testimonials of candidates should be endorsed by the superintending engineer. No time spent in clerical work will be allowed to count."

All this is very excellent and it may show an example to the *deck* in the attempt to provide better efficiency. But there is one part of paragraph 22 which requires elucidation. That part is "all applicants to produce testimonials of ability as an engineer workman." In the present state of chaotic apprenticeship it is very easy to understand what that will mean, and as the Institute of Marine Engineers have kept pegging away at the better organisation and efficiency of the engineers of the mercantile marine, they must now take up the cause of the shops. The apprenticeship question requires reorganising under modern lines. It is impossible to change the modern machine methods of working in the shops, but it is not quite impossible to provide along with that a real training for apprentices, and there is evidence of a new spirit forming in the masters. They do not now so much look on their lads as items in cheap production, and set them to mind machines. There is a pride arising in some masters, and more especially in superintendent engineers, in their apprentices. Superintendents often boast of them when they turn out well or do a good piece of work. The signs of improvement are in keeping with the improved regulations of the Board of Trade; it is an improvement all round.

The Institute then can take up this regulation of the work of apprentices and see that the certificates conform to some rule. Already several engineering masters and superintendents have offered to come into line with regulations which might be drawn up by the Institute of Marine Engineers. They are willing to have their apprentices placed on some regulated system of work and instruction and examination, and it will be for the Institute to take up this question and arrange for it as they have done for the engineers at sea.

The Institute has also now made a new beginning with its experimental and electrical department, Mr. G. Halliday being convener of the Committee, and organising the work. At present there is a project on foot to wire the Institute premises, and later to provide an engine and dynamo for experimental purposes. There are also numerous experimental apparatus to be made, and these are being arranged to be constructed by the members. It is one of the rules that a member shall do something for the Institute, and though that rule is not enforced, it is expected that most of the members will comply voluntarily with the conditions. Perhaps it will be best to appeal to the interest which each member naturally has in the institution to which he belongs. In this way it is expected that a good laboratory will soon be got together.

Then there is the museum of marine engineering fittings. This department can very soon be extended and improved by additions. It is most likely that the new additions or the most of them will be supplied by makers of new designs of machinery. It is on those lines the models have been supplied up to the present, but there are other things which may be sent. Models, for example, of entire fittings of, say, valve gears which the students may work with, and take measurements, and fittings like induced draught arrangements. It will take time to form, but constant and regular application will soon bring things together.

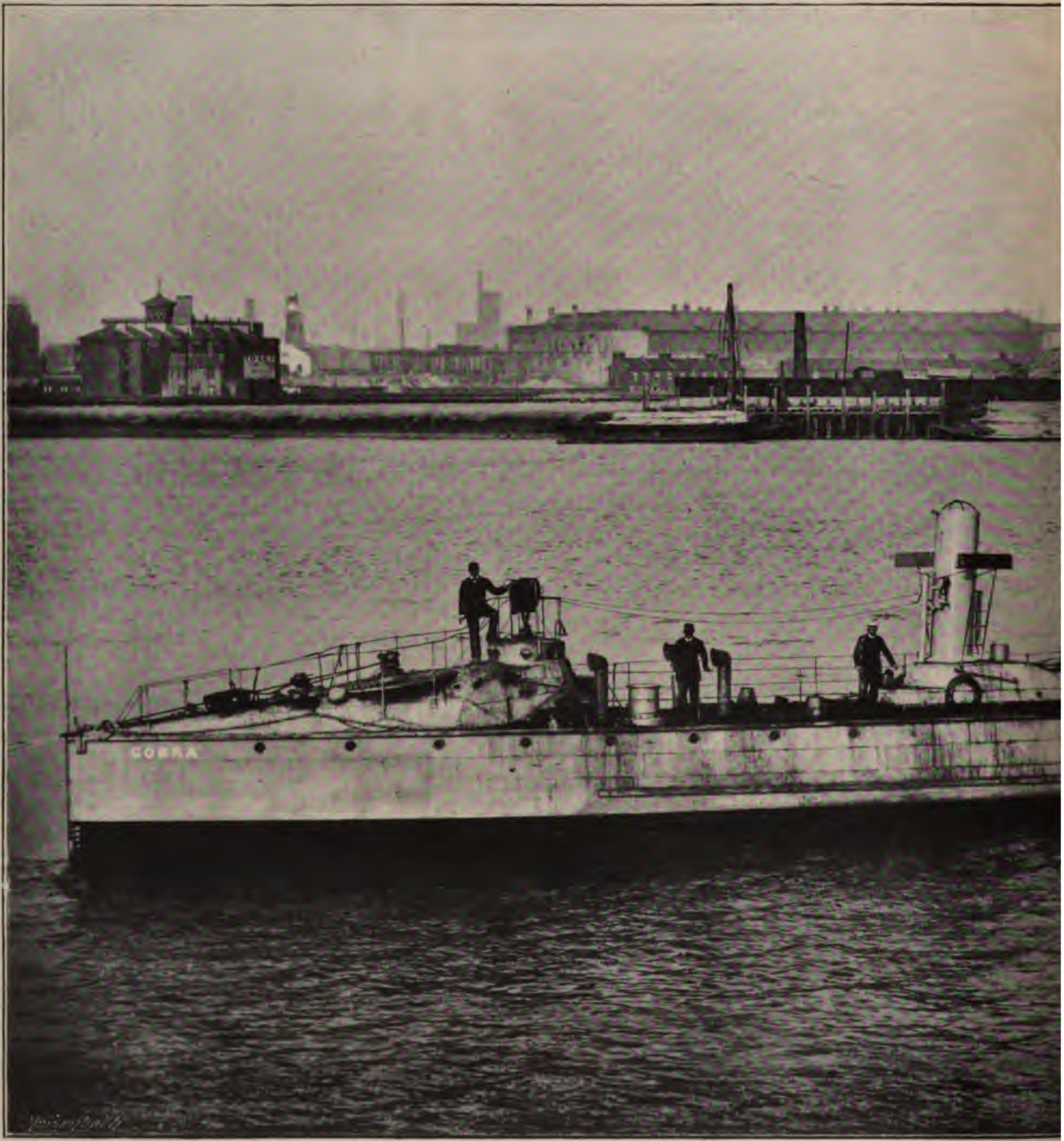
A paper on auxiliary machinery on board ship was discussed during the month. The results of tests were given which astonished many of the members, but on inquiry it was found that they were very nearly in accordance with what was found in general practice. For example, it was found that 250 lbs. of water were required per I.H.P. There are long base pipes which convey the heat away. Then the working of the engines is by *anybody*, and there is not the slightest attempt to economise steam. One man who is working the engine will put on steam when it is letting down a load, and put on the brake to keep it back. So that the engine and load will be working in one direction, and the brake against them both. One feature is the enormous drop in steam pressure, At the boiler it will be 78 lbs. according to one of the tests, and an indicator card will show 4·37 lbs. average pressure. Mr. Girvan, used to the hydraulic system, had much to say in favour of its economy and ease of manipulation. There was not much fear of pipes becoming frozen if proper care was taken of them, then they were perfectly noiseless, which was a great advantage.

The statement of accounts for the Institute of Marine Engineers has come to hand, and we have only space for the general items. The accounts are made up from 1st February, 1898, to 31st January, 1899.

Dr.	£	s.	d.	Cr.	£	s.	d.
General Expenses..	134	13	0	Entrance Fees	83	5	0
Rates, Taxes, &c...	42	1	0	Subscriptions	641	0	6
House Account....	73	14	7½	General Revenue..	4	4	9
Insurance	1	14	6	Transaction Section	15	5	5
Advertisements....	7	0	0	Donations	4	2	0
Depreciation	39	18	3	Recreation Section	229	10	0
Expenses Reading Room	7	14	5	Drawing Class	4	5	5
Papers and Discussions	305	12	1				
Recreation	231	11	11½				
Interest	10	0	0				
Transaction Section	6	10	0				
Bristol Channel Centre	25	12	10				
Southampton Centre	28	8	0				
Balance	67	2	5				
	£981	13	1		£981	13	1

BALANCE SHEET.

LIABILITIES.	£	s.	d.	ASSETS.	£	s.	d.
To Sundry Creditors........	204	10	9	By Cash	404	9	6
„ Subscriptions in Advance	178	11	4	„ Petty Cash ..	1	3	8
„ Denny Gold Medal	261	13	4	„ Consols	336	7	6
„ Stephen's Legacy Fund........	102	10	0	„ Freehold of Institute Building ..	1,500	0	0
„ Interest	7	9	7	„ Furniture	260	13	11
„ Revenue Account	1,984	13	6	„ Insurance	0	19	10
				Balance	235	14	1
	£2,739	8	6		£2,739	8	6



FIRST-CLASS TORPEDO-BOAT, "COBRA," BUILT FOR THE AUSTRO-

AN GOVERNMENT BY MESSRS. YARROW & CO., LTD., LONDON.

A petition is being prepared to be presented to the House of Commons in favour of shipowners in England employing British seamen. Mr. W. Clark Russell, the novelist who writes of the stirring adventures of the sea, has taken the question up, and he appeals to the British people to sign the petition. He heads his appeal, "Food for Great Britain in War! Shall the foreign sailor extinguish the British merchant sailor?" He states that shipowners for years, taking advantage of an ignorance which is largely due to indifference, have been insidiously sapping the life of the British merchant seaman by stealthy but insistent importation of the foreigner, whose recommendation is that he is cheap, that he does not murmur when bad food is given to him, that he is tractable, and that shipmasters choose him in preference to their own fellow-countrymen. "Brassey's Naval Annual" for 1895 states that our "mercantile marine is manned by 235,000 men, of whom 55,000 only are British seamen," which is a little more than half the naval reserve of France. Mr. Russell concludes, "The process of diminution then is steady, and unless the decay is arrested promptly, and by Imperial measures, this country will find itself face to face with a condition that to my mind is little less than appalling—I mean the total and, I fear, the irremediable extinction of the British merchant seaman."

A circular supporting Mr. Clark Russell has been issued from the University, Durham. In this circular it is pointed out that the Government have asked for an expression of opinion in the matter of the excessive employment of foreign sailors in the mercantile marine and the employment of "alien seamen in our merchant vessels deprives many of our own countrymen of employment, and also that it is incurring a very serious risk to leave the food supply of the nation so largely in the hands of aliens in the event of a naval war."

The Marine Engineer has to add its word to the movement, and it is that though in all the industries of the country a new spirit is forming against the old Manchester doctrine of money being the only bond between masters and men, in this, the noblest of English industries, it appears to be living longest and will die last. It may be true that English seamen give trouble, but they are not wholly to blame. Those troubles are mainly due to the Manchester doctrine—after the discharge no further responsibility. And it has gone on until the men on their side have claimed the same rights, namely, disregard for the interests of the employer. If the British sailor is to be again what he was in the days of Drake, of Hawkins and of Oxenham, the shipmasters must learn that the man's cause is their cause and his rights their rights. What interest would Drake's sailors have had in him had he paid them their wages and sent them going with no further claims on him? It was because they knew they had a claim on him and that he would never repudiate the claim which made them stick to him and made them willing to follow him against the Armada, round the world or anywhere. Until this spirit is again created in our merchant seamen, by the masters of our ships, our merchant fleet will remain a disgrace to the Empire.

ELECTRICAL NOTES.

(From our own Correspondent.)

IT has always been found difficult to obtain a reliable governor for marine steam engines, and whether that recently invented by Mr. E. W. Naylor is so still remains a question. There are two steam inlet valves and two exhaust valves. There is also a sickle-shaped contact disk, part of which is insulated, while the other part is a contact plate. There is a permanent contact brush connected to a small generator or some source of current; also two brushes in contact with the sickle-shaped disk, which complete the connection with the steam inlet valves. The other pole of the magnets is connected through wires which join. The governor is coupled up to a draw rod, which by its movement in or out varies the period of contact of the brushes, and so controlling the cut off of the steam from 1 to 100 per cent. of the stroke. The other brushes are adjusted by hand until the best compression is obtained. When the crank is turned, at a certain place the steam valve and exhaust valve are full open. Further round the brush allows release of the steam valve, continuing the rotation the exhaust valve closes. On the return stroke the opposite valves come into operation.

Lieut.-Com. Dana Greene on Electricity on Board Ship.—After all the reports from officers who saw the use and advantage of electrical appliances on board ship in the United States navy, it is understood that the naval officers of the Naval Bureau have decided against its further use. Lieut. Greene, however, is of a different opinion, and in a paper before the A.I.E.E. he gives expression to those views. He says the first-class battleship requires about 2,000 I.H.P. to drive all the auxiliaries at full load, and a first-class cruiser 1,200 I.H.P. About one-half in each case may be supposed to be in action at one time. We can have compressed air, hydraulics, steam, or electricity as the motive power for these, and the Lieutenant sums up in favour of steam or electricity. The disadvantages to steam are danger to life by bursting of pipes, injurious heating of living quarters; but it is simple and reliable, it can be worked by anyone, but is very wasteful. During the late war all the regular war vessels of the United States were fitted with electric lighting plants, and the larger ships with electric auxiliaries, such as ammunition hoists and ventilating fans. Two of the *Brooklyn's* turrets were controlled by steam motors and two by electric motors. All the electrical apparatus stood the test well, and pleased the officers, and they were contrasted with the steam motors. From a careful trial of the steam auxiliaries of U.S. *Minneapolis*, a first-class protected cruiser of about 7,500 tons displacement, with three screws, and a trial speed of 22 knots per hour, it was found there was a great consumption of steam by the auxiliaries. There were between thirty and forty steam auxiliaries, and more than 150 separate steam cylinders. Indicator cards were taken on all the auxiliaries, and losses from leakage, condensation, and radiation carefully estimated, and the water evaporated carefully measured. The steam used by the main engines per hour was 33,620 lbs., and by the auxiliaries 10,146·7 lbs., so that the auxiliaries consumed nearly 25 per cent. of the total coal used. The main engines consumed an average of 20·63 lbs. of steam per I.H.P., and the auxiliaries 119 lbs. per I.H.P. per hour, the lowest being 55·06 lbs. and the highest 318·68 lbs. per I.H.P. per hour. It is reported that the H.M.S. *Powerful* used 8,300 tons of coal from England to Hong Kong, of which 3,400 tons were required for the auxiliaries, which works out to over 40 per cent. On a ship the auxiliaries consume at least 20 per cent. of the steam, which is twice as much as is consumed by them on a central station. The Lieutenant assumes for a first-class battle-ship 1,000 H.P. effective at the motors he would have a three-wire system of 221 to 250 volts. He assumes an efficiency of 82 per cent. for engine and generator, and an average line and motor efficiency of 80 per cent. The total efficiency would be 65·6 per cent. To develop 1,000 H.P. at the motors would require 1,500 H.P. at the engines. It would then require about 30 lbs. of steam per effective H.P., and allowing for losses 37·5 lbs. per I.H.P. per hour as against 119 lbs. by steam on the *Minneapolis* test. The weight of electric plant as against steam plant for auxiliaries will for a first-class battleship be 275 tons as against 100 tons for steam, but there would be a saving of coal of from 200 tons to 400 tons.

Wireless telegraphy may become of enormous advantage to the Mercantile Marine and the Navy, and the latest experiments may be of some interest. These were made by Herr K. Strecher, at Miggelsee, some twelve miles from Berlin. He used, says *Electrician*, an induction coil of 50 c.m. spark and a motor-driven mercury interrupter, breaking the primary circuit 20 times per second. The wires connected to the transmitting and receiving apparatus were 100 metres long and parallel to one another, the distance between them being 5·7 k.m. Bronze wire, supported on ordinary telegraph poles and insulators, was employed. There were no obstacles between the wires. Several wires were connected in parallel, but the experiments did not show whether or not this was an advantage. The transmitting station was on a hill 800 metres from the eastern end of the lake and the receiving station at the western end. In spite of wet weather and difficulties in keeping apparatus dry the experiments, which were continued for some weeks, were successful. Strecher's conclusion is that using horizontal wires signals can be transmitted over a distance 50 times the length of the wire.

As auxiliary machinery is so much spoken of it is interesting to learn that Messrs. W. H. Allen, Son, & Co., of the Queen's Engineering Works, Bedford, have constructed two surface condensing plants for the Glasgow Corporation Electricity Works, the pumps, air and circulating being driven electrically. They are three-throw, have no foot valves, nor have the brackets packing rings. Each condenser has a tube surface of 1,250 square feet, and consists, says *Engineering*, of a circular cast iron shell with the supporting feet and all the necessary branches cast on. It has bronze tube plates, and solid-drawn bronze tubes ¾ in. in external diameter. The holes in the tube plates are drilled and tapped to form recesses for tape pinchings, which are screwed up tight by means of bronze ferrules, making the joints round the tubes steam and water tight. The steam circulates round the outside of the tubes, and the cooling water passes through the lower half of the tubes in one direction, then in the opposite direction through the upper half of the tubes. Two large doors, one at each end of the condenser, give easy access to the tubes for cleaning and re-packing. The pumps are driven through Hollick's friction gear. The large friction wheel of this gear is keyed to the crank shaft, while the smaller wheel is carried by a vibrating frame centred in the crank shaft, in such a way that by elevating or depressing a handle the two wheels can be put out and into gear with the small pulley in the dynamos spindle. This pulley lies between the two wheels, and the apparatus is put into gear by pulling down the swinging frame, thus pinching the motor pulley between the two wheels, while the thrust is balanced by the belt tension. A feature in this system is that the motor can be started by itself, and when running at the correct speed the pumps can be put into operation by means of the friction lines. The pumps run at a speed of 150 revolutions per minute, and the motor at 800 revolutions; 15,000 lb. of steam are dealt with per hour. The centrifugal circulating pumps have 7 in. suction and discharge branches; the revolving discs are 12 in. in diameter. Each pump can discharge 1,000 gallons of water per minute through the condenser against a total head of 10 ft. The speed of the pump is 530 revolutions per minute. The motors for air-circulating pumps are wound for 500 to 600 volts.

THE AUSTRIAN TORPEDO-BOATS.

We give a double-page plate-illustration of the Austrian torpedo-boat *Cobra*, constructed and engined by Messrs. Yarrow & Co., Limited. The Austrian Government had two made of the same type, one by Messrs. Yarrow and the other by a continental firm. Messrs. Yarrow built the *Viper*, which, on trial, reached a speed of 26½ knots on a three-hours' run with a load of 26 tons on board. In consequence Messrs. Yarrow received the order for the four remaining boats of the order. The *Cobra* is 152 ft. 6 in. long and 15 ft. 3 in. beam, constructed of galvanised mild steel, and sub-divided by transverse bulkheads. She is stronger in the scantling than usual. The armament consists of three pivoted torpedo-tubes for 18 in. diameter torpedoes, two placed forward and one aft, and two quick-firing three-pounder guns. The engines are triple-expansion, with three cylinders 18 in., 26 in., and 39½ in. in diameter by 18 in. stroke, driving a single screw. Steam is supplied by two water-tube Yarrow boilers. The boat is fitted with electric light engines, steam steering gear, forced draught engines, fresh water condensers, electric ventilating fans, and pumping engines. The engines can develop 2,000 I.H.P. The bunkers carry sufficient coal to give a radius of action of 1,500 nautical miles at 10 knots.

With steam pressure of 180 lbs. and 340 revolutions per min., and with a load of 44 tons, she made a speed of 24·265 knots. The speed is lower than that obtained by the *Viper*, but the load was much greater. It was considered desirable to make the armament of the *Boa* equal to that of a destroyer. If the *Viper* could carry 26 tons and make 26½ knots a destroyer of three times the displacement and three times the *power* should be loaded to 78 tons, and her speed of 30 knots would fall to 27½ knots, which is only one knot higher than the *Viper*. But a torpedo-boat like the *Boa* would cost only about one-third as much as the destroyer, and would require from 10 to 12 men less to work her—about 30 for the torpedo-boat, and 50 for the destroyer.

The third of the four torpedo-boats passed through her official trial on Wednesday, March 15th, and obtained a speed of 24·3 knots for three hours' continuous steaming. The guaranteed speed was 24 knots, carrying a load of 44 tons. This load represents the boat in absolutely complete sea-going condition, with bunkers full and all armament on board. On March 21st the official trial took place of the torpedo-boat *Python*, the last of the four torpedo-boats. The Austrian authorities were represented by Commander Ladislaus von Sztranyavszky (Naval Attaché), Mr. Grond, and Mr. Groger. The speed realised was 24·34 knots, the revolutions being 350 and the steam pressure 170 lbs. The load carried was 44 tons, representing the vessel fully equipped under service conditions.

FLOATING OF H.M.S "GLORY."

On Saturday morning, March 11th, Her Majesty's first-class battleship *Glory* was floated from Messrs. Laird's shipbuilding yard at Birkenhead.

Owing to the recent death of Mr. William Laird the ceremony of floating was kept as quiet as possible, but a vast concourse of people had assembled to witness it.

The usual service was read by the Rev. J. W. Hughes-Games, M.A., Vicar of Birkenhead, and the vessel was christened by Mrs. John M. Laird, wife of the senior member of the builders' firm.

The *Glory* is of the *Canopus* class, designed by Sir William H. White, K.C.B., Director of Naval Construction, and as this class of vessel is now well-known, we will offer only a short description. Her dimensions are:—Length, 390 ft.; breadth, 74 ft.; mean draft, about 26 ft. 6 in.; displacement, 12,900 tons; freeboard forward, 22 ft. 6 in., aft, 19 ft.; I.H.P., 13,500; speed about 18¾ knots; having a total stowage for about 2,000 tons of coal. The armour is of Harveyed steel, and there is a protective deck, from lower edge of armour, covering machinery, magazines, and other vital parts.

The ship is lighted throughout with an installation of about 750 electric lights, and equipped with six search lights of 30,000 candle power, each of which is capable of being worked by dynamos under protection.

The officers and crew are accommodated on the main and belt decks.

The upper deck extends from stem to stern without a break, and above it is a continuous bridge deck extending the whole length between the barbettes, and on this deck are the conning towers, surmounted by navigating bridges (which will be about 36 ft. above water), and the chart house.

The masts, two in number, are built of steel, fitted with military and signalling tops, and are already in place, and complete with their derricks for hoisting boats, &c.

The armament of the *Glory* will consist of four 12 in. 46-ton guns, mounted in barbettes, in pairs, and firing a projectile weighing 850 lbs., with a powder charge of 148 lbs. There are 43 quick-firing guns in all—12 6 in. on the main and upper decks, mounted in casemates protected by 6 in. armour, 12 12-pounder, six 3-pounder quick-firing, eight small machine guns, and five field guns. There are also four submerged torpedo tubes for 18 in. torpedoes.

The main propelling machinery constructed at the Birkenhead Iron Works consists of two sets of engines of the triple-expansion inverted type of the latest design. Each set is placed in a separate engine-room. The cylinders are H.P. 30 in., I.P. 49 in., and L.P. 80 in. in diameter respectively, with a stroke of 51 in.

The boilers, 20 in number, are of the Belleville type (with economisers), working at a pressure of 300 lbs., and are placed in three separate water-tight compartments.

The *Glory* illustrates the advantage of building these large battleships in dock in preference to building them on a slip and launching them, as she floats out with all her citadel and casemate armour and most of the barbette armour in place; indeed, all the armour-plating would have been completed had it not been for the press of work in Sheffield rendering it impossible for armour-plate manufacturers to make delivery as early as required. A considerable portion of the boilers is on board. The whole of the auxiliary machinery is in place, and their pipes and connections are being fitted. The main engines are erected on board with the exception of the cylinders, so that the vessel, as floated out from the building dock, is in a far more advanced state than would have been the case had she been launched in the ordinary way, her displacement on floating out being approximately 9,000 tons.

This feature is brought into singular prominence at the present time as Her Majesty's ship *Implacable* of 14,900 tons displacement, for which the machinery of 15,000 H.P. is also being built by Messrs. Laird Brothers, was launched from Devonport on Saturday March 11th, her weight being about 4,500 tons.

It is expected that the *Glory* will be ready to hoist her pennant within six months, but the *Implacable* is not expected to be ready for hers for about fifteen months.

H.M.S. *Glory* and H.M.S. *Implacable*, launched at Devonport, are coated with Hartmann's Rahtjen's improved composition (the Red Hand brand), which is also applied to 283 of Her Majesty's vessels.

The *Glory* will have a complement of 750 men.

It may be mentioned that the name *Glory* was originally taken from *Gloire*, a French man-of-war captured by the *Chester*, one of the British Channel Fleet in 1709.

A *Glory* also participated in Lord Howe's victory on the 1st of June, 1794, and in Sir Robert Calder's victory off Ferrol in 1805.

After the ceremony the guests adjourned to the model-room, where refreshments were served. Over the subsequent proceedings Mr. John Macgregor Laird presided, and proposed the toast of "The Queen," which was duly pledged.

Mr. J. M. Laird next proposed "Success to the *Glory*." He said they had that day witnessed the interesting ceremony of floating one of the largest battleships ever built in any country. It was usually the custom of the firm to have a large number of representative people with them in watching that ceremony and wishing God-speed to the ship, but on the present occasion they had decided to make the function a more quiet one. The reason for this was known to all of them. It was due to the very recent loss the firm of Laird Bros. had sustained through the death of Mr. William Laird, the senior partner. Under these circumstances he felt it would not be seemly to have a very large gathering, and they therefore had as guests that day only a few there who were directly interested in the family or the works. Another point which made it rather sad for some of them—in fact for all of them—was that it was little more than twelve months since Mr. John Laird, who had for so many years been a most active partner in the firm, was also taken from them. The worth of both Mr. William and Mr. John was testified to by the unanimous sympathy and respect which was shown, and he was sure that the sympathy and respect shown, not only in Birkenhead, but far beyond it, had been a great encouragement to those left to carry on the concern. Such a concern as that of Laird Bros., building ships of the type of the *Glory*, and the large variety of other works they had to deal with, could not be carried on, however willing the partners might be, without the assistance of a faithful and efficient staff. They had been fortunate in having left to them by the late partners such a staff. Perhaps it was unequalled in experience in warship building in the world. It was the intention of the younger men who had now control of the concern to follow, if they could, in the steps of their predecessors, and carry on the work on the same lines, and trust would be imposed as hitherto in all the members of the staff. They relied on the experience of the older members, the energy of the younger and the *esprit de corps* of the whole of it. There was one point in connection with this he would like to mention on that, the first time he had made any public remarks recently—and that was that their trusted engineer, Mr. Bevis, who had been with them and associated with his (the speaker's) father and uncle, and with his grandfather before them for a period of 45 years, had decided at the end of 1898 that he would retire from the active control he had taken and become more of a consulting engineer. They had, however, the full benefit of his cordial assistance and advice in all points of difficulty, and they were fortunate in having his son, Mr. Ratsey Bevis to step into his position as engineering manager, and under his régime with all his energy and vigour he felt sure that in that department Laird Brothers would still continue to lead. Having noticed these few points he came to the business of the day, and that was to ask them all to drink success to the vessel they had just seen floated from the dock. He did not propose to make many remarks, but would say that she was the third of a series of four large first-class battleships which had been entrusted by the Government to their firm to build since 1889. That was a record to which no shipbuilding firm in the country could show an equal. Some firms had had three, some two, and some one, but none had had four except themselves. The first was the *Royal Oak*, and she, when she was built, was floated out from the same dock as the *Glory*, having only about 55 per cent. or a little over half her total load displacement worked into her, and taking twelve months to finish her. In the case of the ***Mars*** she had about 65 per cent. of the total final weight into her when floated, but in the *Glory* they had gone a step further, and she had fully 75 per cent. Instead of twelve months, as in the case of the *Royal Oak*, and nine months for the *Mars*, they quite expected to have the *Glory* away by her contract date, and within six months from the present time. No other battleship ever floated or launched was in so far advanced a condition. He was glad to say that the Government had recently ordered the *Exmouth*, one of the vessels of the *Duncan* class; she was to be larger, more heavily armoured, more heavily armed, and faster than any battleship ever designed by any country previously. She was to occupy the dock just vacated by the *Glory*, and if they could rely upon the workmen of Birkenhead to do their best, to be regular in their attendance, and when at their work to do a full day's work, he had no hesitation in saying that they would equal, if not beat, the results they had attained in the *Glory* in rapidity of construction, and it would be an encouragement to them as employers of labour to undertake more orders, which were always competitive, from the home Government, or from foreign Governments, and bring further work to that district which had in the past turned out so many famous ships, but of which their firm remained the sole representative of the largest class of shipbuilding work! The present week had brought plainly before them the question of navy expenditure, and he thought Mr. Goschen in his speech had fully explained the advantage and intention of the Government to keep apace with all shipbuilding that was done in any other country. It would be perhaps unnecessary in these days to say very much more about the importance of a strong navy, but during the last year it had been more brought before their notice as an object lesson than previously, and if a strong navy was to be the means of bringing peace and preventing war, then it was a very small insurance premium for them to pay to meet the wise, though perhaps somewhat lavish, expenditure that was being made by the present Government. They all knew that if war were to come the expenditure now proposed would be nothing if it were to secure the safety of their food supply and the protection of their world-wide commerce. But whether the *Glory* was destined to be a ship to prevent war, or, if it came to the worst, to take part in war, they must wish her success, and he begged them to join with him in doing so. Other toasts followed.

In addition to the *Glory*, Messrs. Laird Brothers have the following work in hand, the ***Express*** and ***Orwell*** now undergoing their steam trials, two single-screw sloops, H.M.S. ***Mutine*** and ***Rinaldo***, of 980 tons and 1,400 H.P., and a 30-knot destroyer for the Russian Government, which will shortly be ready for launching; a paddle-wheel steamer, launched last month, for the South Eastern Railway Co.'s Folkestone and Boulogne traffic, intended for a very high speed, and with nearly 6,000 H.P. engines; a first-class battleship for H.M. Navy of 15,000 tons and 18,000 I.H.P., to be named the *Exmouth*, is to be laid down immediately in the building dock just vacated by H.M.S. *Glory*.

In addition to the foregoing vessels, there are in progress a set of twin-screw engines of 15,000 H.P. for H.M.S. *Implacable*, which is building at Devonport Dockyard, and a set of water tube boilers for H.M.S. *Blanche* to replace her original locomotive boilers.

THE INSTITUTION OF CIVIL ENGINEERS.

WATER-TUBE BOILERS FOR MARINE ENGINES.

AT the ordinary meeting of the Institution of Civil Engineers on Tuesday, the 7th March, Mr. W. H. Preece, C.B., F.R.S., the President, in the chair, two papers relating to recent advances in Marine Engineering were read.

The first paper, on "Water-Tube Boilers for Marine Engines," by Mr. J. T. Milton, consisted mainly of a description of the various types of water-tube boilers most in use for marine purposes in this country. For all recent vessels of the Royal Navy water-tube boilers of different type had been adopted, while very few had been fitted in merchant steamers.

The difference in practice in the two cases was accounted for by the different conditions of the services required. In most vessels of the merchant service economy of coal consumption, durability of boiler, and facility of cleaning and inspection, were of far more importance than considerations of weight and space in proportion to power exerted; while in some war-vessels the importance of obtaining very large powers on small weights outweighed the questions of coal economy and durability.

The question of economy in boilers was largely dependent upon the completeness or otherwise of the combustion of fuel in the furnaces. The conditions required for perfect combustion had long been well known, but they were difficult of realisation in actual working practice. So far as the merchant service was concerned the general introduction of a new type of boiler would depend upon its economy obtainable under ordinary conditions of work, not upon the results of special trials. In some boilers the conditions for perfect combustion could be approximately met by very careful stoking, but were unattainable under ordinary working conditions at sea with ordinary firemen. In such boilers, while excellent results might be obtained upon special trials, conducted under the direction of skilled engineers and with expert firemen, inferior performances were obtained at sea in every-day service.

Reference was made to the question of circulation of water in water-tube boilers, and experiments made upon this subject by Mr. A. F. Yarrow, Mr. J. I. Thornycroft, and by the late Mr. A. Blechynden, were quoted. The experiments of the last-named were made upon a full-sized boiler. The boilers first described and illustrated were those made with comparatively large tubes. They comprised the types known as the Belleville, which was so extensively used in the large vessels of the Royal Navy; the Lagrafel d'Allest, used in the French Navy and Merchant Marine; the Niclausse, and the Babcock-Wilcox, the latter being the type most frequently adopted in the few cases in which water-tube boilers had been used in British merchant vessels. Amongst small-tube or "express" boilers used in light vessels, such as destroyers and small cruisers, the Normand, Yarrow, Thornycroft, Reed, and Blechynden boilers were described. Descriptions were also given of the Fleming and Ferguson, Mumford and Haythorn boilers.

With water-tube boilers, owing to the small quantity of water contained in them and the high rate of evaporation obtainable, automatic feeding was essential. Some types of apparatus providing for this were described.

For prolonged work, as compared with short trials, the author considered that straight tubes were very desirable, as much greater confidence could be felt in a boiler where all the tubes could be seen through, than in one where much had to be taken on trust, and good results could not be expected to be obtained from mechanism in which implicit confidence was not reposed.

MACHINERY OF WARSHIPS.

The second paper, on "Machinery of Warships," by Sir A. J. Durston, K.C.B., and Mr. H. J. Oram, R.N., M.Inst.C.E., gave particulars and remarks on the construction of warship machinery and details of the results obtained since the date of the paper read at the Institution in November, 1894.

In 1893, an Admiralty committee recommended that the total boiler heating-surface per I.H.P. at natural draught trials should be not less than 2·5 square feet, and that the increase of power due to forced draught should be reduced. The effect of this was seen in increased weight of water-tank boilers over those given in the last paper.

All the vessels described had triple-expansion engines.

In an appendix particulars were given, first, of recent battleships. In the *Majestic* class the boilers were larger and engines more substantial than in ships built under the "Naval Defence Act," the power was easily obtained and the forcing was moderate. The boiler-tubes were fitted with cap ferrules, and no trouble had been experienced with leaky tubes. Particulars of the *Canopus* class, which would soon be ready for trial, showed a considerable decrease in the weight of machinery per I.H.P. The steam pressure and ratio of cylinders had been increased from that in older vessels, and Belleville boilers with economisers were fitted. The machinery of the six vessels of the *Formidable* class was similar to that of the *Canopus*, but more powerful.

Particulars followed of first-class cruisers, of which the *Powerful* and *Terrible* were fitted with Belleville boilers without economisers, and showed a decrease in the machinery weights on cruisers built under the Naval Defence Act. The steam pressure and ratio of cylinders were greater than in these last-named vessels. In the *Diadem* and *Argonaut* classes, the steam pressure and ratio of cylinders were still further increased. Belleville boilers with economisers were fitted.

Of the second-class cruisers, the *Talbot* class with water-tank boilers, the boilers were all single-ended, and more heating surface per I.H.P. was allowed. In the *Arrogant* class Belleville boilers were fitted. There was a decrease in the weight of machinery compared with the preceding 9 vessels and vessels built under the Naval Defence Act.

Another table gave particulars of the new third-class cruisers. These vessels were fitted with water-tube boilers of the small-tube type. The machinery was 150 tons lighter than in preceding vessels of similar type and same I.H.P.

Particulars followed of the Torpedo-Boat Destroyers. They were fitted with triple expansion engines, running at 350 to 400 revolutions per minute, and with water-tube boilers of the small-tube type. The speed varied from 26 and 27 knots in the earlier boats, to 30 knots and over in the newer ones. The machinery was made as light as possible, and the boilers were subject to considerable forcing. Reference was made to the *Viper* with Parson's marine steam-turbine.

All recent large engines and some of smaller size had two L.P. cylinders. With four cylinders the twisting moment was more uniform, and the cranks could be more easily arranged to minimize vibration. The weight and length of engines were thereby increased. Piston valves were generally fitted to the H.P. and I.P., and flat valves to the L.P. cylinders. The sequence of cylinders and angles of cranks were such as to reduce vibration as much as possible. In recent four-cylinder engines the power developed in each of the two L.P. cylinders had been made about half that in each of the other cylinders and the working parts made smaller. In the *Terrible*, experiments had been carried out with propellers connected and disconnected to test the effect on vibration of varying the angles of the cranks. The results and also the calculated inertia forces and couples were shown. With the present arrangements vibration in this ship had disappeared. In most fast-running engines it had been also found advisable to fit suitably arranged balance weights to the crank arms.

With reference to induced draught, further experiments with this system had not shown any advantage except that the stokeholds were open. There was also liability to overheating of the fans.

Further experience with water-tube boilers had led to their general adoption for warships. In considering the type most suitable, the principal points to be considered were weight and space required, economy and durability. On account of the last two considerations, boilers of the large-tube type had been adopted for the larger vessels. The Belleville boiler was fitted in these vessels, and in recent cases these had been fitted with economisers, the number of tubes in the generators being reduced. Trials on shore showed twelve to fifteen per cent. increase of economy due to the use of these economisers.

The *Salamander*, with Babcock-Wilcox boilers, had successfully passed through her trial.

The *Seagull*, with Niclausse boilers, was at present undergoing trials.

In the smaller fast vessels, to reduce weight, boilers of the small-tube type were generally fitted. Experience had shown that the ordinary life of the tubes of the Belleville boiler, under ordinary circumstances, would be not less than two commissions. In small tube boilers this life would generally be much less.

Zinc slabs, though still of use in arresting corrosion, could not from the nature of construction of water-tube boilers be so effective as in water-tank boilers. The parts of the boiler near the feed-water inlet appeared to be very subject to corrosion, and this appeared to be due to the liberation of air and other gases from the feed-water at this part. It was endeavoured to minimize this action by using distilled water whenever possible. In Belleville boilers the economizer tubes in which the feed-water was first discharged were galvanized inside as well as outside.

Some cases of bursting of tubes had occurred, due in most cases to their choking with dirt.

In recent vessels the steam pressure had been considerably increased. No difficulties of importance had been experienced due to this. The effect on the weight and space required was shown in an appendix.

In the discussion which followed the papers Sir E. J. Reed showed himself in favour of the water-tube boiler for other reasons. Sir Edward thought that all the heating surface of the water-tube boilers was better brought into use while only the part of the tube nearest the tube plate was of much use for co-operation in the case of the return tube boiler. He had a recollection of experiments he made in conjunction with Mr. C. Wye Williams with tubes surrounded with water and the hot gases going through them. The water space through which the tubes passed was divided into compartments, and the evaporation produced by the tube in each was measured. When this was done it was found that almost all the evaporation had taken place in the compartment next the tube plate. But Sir Edward had forgotten one thing when he made the statement; he forgot that the tubes with which he had made the experiments were new and without scale, while the tubes in use in future tube boilers are by no means without scale. Further than that it happens that where the evaporation is greatest there also the deposit of scale is greatest, and the thicker the scale the greater is the resistance to transmission of heat. It comes therefore about that the scale and the tubes soon strike a balance with the result of a better distribution of evaporation along the tube. More evaporation takes place at parts of the tube nearer the smoke-box end, while less takes place at the parts of the tube nearer the tube plate next the combustion chamber. It is thus the chimney gases are lighter in temperature at the end of a long voyage with a corresponding loss in efficiency.

Professor Kennedy raised a still more important question when he hinted that a division of the work of the engine from the work done by the boiler in trials would give better information of what was going on. It is quite useless to anyone who is anxious to know what the boiler is really doing to tell him how much coal is required per I.H.P. The engine may be doing all sorts of things, and in any two cases it may be doing unlike things so that no comparison can be made. What one wants to know is the evaporation of the boiler per pound of coal under different conditions of firing. In the shop trials of the boilers, or in their mooring trials, they are sometimes given, but hardly ever in other cases. The trials ought to be conducted so that the performance of the engine is obtained and also the performance of the boiler, and these quite separately.

Mr. Manuel, of the P. and O., also raised an important question with special reference to the merchant service. That was the consumption of coal per I.H.P. as shown by the figures given in Sir John Durston's paper and the performances of the merchant service. In hardly any case where full power was developed was there less than two pounds of coal consumed per I.H.P. While in the merchant service he had a case which he recollected of about the same horse-power, 6,000, where with Howden's forced draught they had 1·5 lbs. of coal consumed per I.H.P. And then thrown in with this is the safety to the stoker and want of constant anxiety to the engineer. Mr. Sampson thought Mr. Manuel had not made sufficient allowance for the different engines and the waste of auxiliaries. The conditions of working the engines and the arrangements of steam pipes in the navy and merchant service are altogether different. Also, there is the human factor, and the water-tube boiler was more humane than the other. Mr. Sampson should have heard the remarks made by engineers and stokers who have worked water-tube boilers. They are not flattering, and they do not appear very grateful for the humane treatment to which they have been subjected. Of the question of combustion Mr. Milton felt himself more free to speak, and even to go into the chemistry of the question. But, after all, the chemistry of the question does not carry us far; it is the arrangements in the construction of a boiler for completely consuming the furnace gases, which are interesting. Of these arrangements Mr. Milton awards the highest position to the Scotch boiler, and the fact is true, that the Scotch boiler is arranged to give good combustion; but there is another fact equally true, that there are other boilers of the most unlikely design for producing complete combustion which do so nevertheless. And this permits an enquiry whether there are not other conditions besides the construction of the boiler which lend themselves equally to the production of complete combustion.

After Mr. Robertson, Mr. List, of the Donald Currie Line, pointed out that they had reached the limit in the tank-boiler in size and pressure, and if higher pressures were required, they would require to look to the water-tube boilers to supply what they wanted. There is no question that Mr. Milton was right when he said the conditions to be fulfilled in the Merchant Service were quite different to those in the Navy. But it was not true to say the water-tube boiler adopted by the Admiralty was without economy. From what he heard the engineers and stokers were very well pleased with the working of the Belleville boiler. He did not say it was the best boiler. The Engineer-in-Chief of the Navy, being a practical man, had the problem of the supply of steam set before him, and had to choose the best he could obtain. And the Admiralty were quite right in their policy, and deserved the thanks of the nation for fitting war vessels with water-tube boilers.

Mr. Davey addressed himself to the question of circulation, and spoke of the important experiments by Mr. Yarrow, which showed that it did not matter which leg of a bent tube was heated, the circulation of the water would continue to go in the same direction when once it had been started. He gave the case of a mine shaft full of air. The air got heated at the bottom and no circulation would take place. As soon, however, as the air was set in motion by an impulse on the top of one shaft it continued to go in that direction, and kept up the circulation down one shaft and up the other.

Mr. Wingfield spoke of the reference to a bent tube naturally being made thinner owing to its being bent. It was quite true that a tube did become thinner when it was bent backwards and forwards until it weakened and broke, but in the case of the bent tube of a boiler this was true to a very small extent. He also pointed out that Mr. Milton was not quite right in saying that the difference of heat of the water in the tube placed for measuring the circulation did not do so. The difference of heat was due to various causes, and only a part of that heat could be said to be due to that which caused circulation.

Sir Wm. White was satisfied from the discussion that the Engineer-in-Chief had been going on the right lines in fitting water-tube boilers in war ships.

Sir John Durston spoke of the long-time trials at full power and three quarters power with all the boilers in operation at other times with a proportion only of them in work. He pointed out that when large vessels went through their trials steaming at full power for 57 hours without a hitch, and in another case 59 hours without any trouble, they were on the fair way to success. And it must be remembered that this type of boiler was new and they were making improvements.

THE INSTITUTION OF MARINE ENGINEERS.

THE FIRST DECADE—PAST PRESIDENTS.

(*Continued from page* 356.)

SIR ALBERT JOHN DURSTON, K.C.B., R.N., born 25th Oct., 1846, at Devonport, educated at Mr. Robert Barnes' school at Newport, Isle of Wight, from which, in Feb., 1866, he entered by Civil Service examination, H.M. Dockyard, Portsmouth, as an engineer student. He served there under the late Mr. Andrew Murray, who was chief engineer until June, 1868. In that year he entered the Royal Navy as assistant engineer with seniority in June, 1866. During a portion of this period, from November, 1865, till he entered the Navy, he was a student at the school of Naval Architecture and Marine Engineering, and as such attended there during the winter six months, or from November to April of each of three years.

In October 1869, he was appointed to H.M.S. *Ocean* in China, and returned home in that ship in June, 1872.

Captain (afterwards Admiral) Sir William Hewett, K.C.B., R.N., commanded him during this commission, and Vice-admiral Sir John A. Fisher, K.C.B., R.N., now Commander-in-Chief of the North American and West Indies station, and recently controller of the Navy, was commander.

In the usual course Sir John received his promotion to

engineer R.N. in 1871. In October 1872 he was appointed for duty as an assistant engineer in H.M. dockyard at Portsmouth, and in 1877 he was promoted to first assistant to the chief engineer, and in the same year he received special promotion to chief engineer R.N.

Sir John continued to serve under the much esteemed late Edward Newman as his first assistant till 1881, when he was promoted to chief engineer of H.M. dockyard, Sheerness, and at the death of his dear friend and former chief in 1883, naturally succeeded him as chief engineer of Portsmouth yard.

In 1888, Sir John was transferred to the Admiralty as chief engineer inspector, and was promoted to engineer-in-chief of Navy in April, 1889, in succession to the late Richard Sennett, who at that time left the Admiralty to join the firm of Maudslay, Sons, & Field. In 1888, Sir John was promoted to the rank of inspector of machinery R.N., and to chief-inspector of machinery R.N. in 1893, and he is now the senior engineer officer in the Navy.

During Sir John's period of office, the machinery of the Navy has been more than doubled in I.H.P., and the steam pressure has been also practically doubled from 155 lbs. to 300 lbs. per square inch. The water-tube boiler has replaced the locomotive and cylindrical type.

Sir John has not been without appreciation from his Sovereign. Her Majesty created him a C.B. in 1895, and a K.C.B. in 1897. He is a vice-president of the Institution of Naval Architects, and past president of the Institute of Marine Engineers, and honorary member of the Institute of Engineers and Shipbuilders in Scotland. His clubs are the United Service, Royal Naval Engineers and North Surrey Golf.

Sir John has read many scientific papers before the Institution of Naval Architects, and takes part in all their discussions. His experiments on the effect of grease on the transmission of heat through the plates of boilers, and on their temperature on the fire side have been of great service to those who have to construct boilers.

WILLIAM HENRY WHITE, C.B., LL.D., F.R.S., was born at Devonport, February 2, 1845, and educated at the Royal School of Naval Architecture, South Kensington, while it was under the charge of the council, the Admiralty supporting it. In 1867 he came out at the head of the list of students of the school, and became a Fellow of the Royal School of Naval Architecture. When he left he was appointed to the construction department of the Admiralty, and in 1883 he had risen to be Chief Constructor. From 1870 to 1881 he held the position of Professor of Naval Architecture, both at the Royal School and the Royal Naval College, and still attended to his duties at the Admiralty. From 1883 to October, 1885, he was away from the Admiralty organising and directing the shipbuilding department of the Elswick Works of Sir William Armstrong & Co., and while there built a number of warships for foreign Governments of great speed. The Lords of the Admiralty sent for him to come to them again, and then appointed him Director of Naval Construction and Assistant Controller of the Navy. The work of the Admiralty in providing for the increasing needs of the Navy is growing year by year, and Sir William has been kept of late years at high pressure. Under the Imperial Defence Act of 1888 he had to design and build a new squadron for the protection of trade in Australasian waters, the cost of which was £850,000. In 1889 he had to provide another set of 70 vessels at an estimated cost of £21,500,000, which were to be completed in five years. From 1886 93, 131 vessels had been completed and added to the Royal Navy under Sir W. H. White. He is an LL.D. of Glasgow University, Fellow of the Royal Societies of London and Edinburgh, Vice-President of the Institution of Naval Architects, Past President of the Institute of Marine Engineers, Member of the Council of Mechanical Engineers and of the Institution of Civil Engineers, Honorary Member of the Institution of Engineers and Shipbuilders in Scotland, the North-East Coast Institution of Engineers and Shipbuilders, and the Society of Engineers; Member of the Iron and Steel Institute, the Association Technique Maritime of France, the Royal United Service Institution and the Royal Institution, Fellow of the Royal School of Naval Architecture, the Imperial Institute, and the Society of Arts. His "Manual of Naval Architecture" is the standard work, and it has been translated into German and Italian. He has contributed numerous papers on the science and practice of shipbuilding to the societies of which he is a member.

PETER DENNY, LL.D., was born at Dumbarton, Oct. 21st, 1821. His father, William Denny, was a shipbuilder, and he died in 1833, leaving a widow with 11 children. Peter remained at school until his 14th year, and after was engaged as a clerk to the local sheriff's officer, and then at Christie's Glass Works. Here he remained until 1843, when he became a pupil of his brother William, manager of Napier's shipyard at Govan. Later he joined his brother Alexander as a naval architect in Paisley.

The premises occupied by the father was called the Woodyard, which was on the west side of the Leven, a little below the bridge. The father had first been a carpenter, then managed as partner, then as proprietor. His brothers were William, mentioned above, James, Alexander, and Archibald. William was the most able. When Peter left to be with him he wrote: "My brother William kindly asked me to come and stay with him in Glasgow, and he would make a shipbuilder of me, setting me at once to work on plans at his lodgings. I felt it so difficult and strange that I would have given it up at any moment; but with his usual kindness he had patience with me and persuaded me to stick to it. I did, and soon got confidence, and progressed so that he was able to take me in as an assistant in the Govan Yard, I think towards the end of the year, August, 1843, at 30s. a week.

At the close of 1843 Peter joined his brother Alexander at Paisley, where he prepared specifications, plans, &c. William returned from America in 1844, when he, Alexander and Peter formed a partnership under the name of Denny Brothers, as naval architects. In 1845 they started as shipbuilders, on the east side of the Leven shore. Up to 1845 wooden vessels from 50 to 200 tons were built at Dumbarton, but Denny Brothers started building with iron at once with the paddle steamer *Lochlomond*, of 95 tons and 70 N.H.P., and during the same year they built the paddle-steamer *Rob Roy*, of 30 tons and 15 H.P., and the screw steamer *Water Witch*, of 240 tons and 35 H.P. The *Water Witch* was the first mercantile screw steamer built on the Clyde. Out of some 530 vessels which the firm has built only four have been sailing vessels. In 1846 Alexander left them and started with Archibald for themselves; and James came home from America and joined William and Peter, under the new name of William Denny & Brothers.

In 1850 Peter Denny proposed to his brothers that he should commence an engineering business in the town, so he entered partnership with Mr. Tulloch, of Greenock, and his brother-in-law, Mr. John MacAusland, the partnership being designated Tulloch & Denny, but in 1852 this was changed to the present name—Denny & Co.

In 1852 William Denny & Brothers built for the Cunard Co. the iron screw steamers *Australian* and *Sydney*, each of 1,400 tons and 300 N.H.P. They were at once sold for the Australian Mail Service. In the same year the *Alps* and *Andes*, each of 1,440 tons and 300 H.P., were built, and they were the first screw steamers of the Atlantic passenger trade. The engines, made by Tulloch & Denny, were of the "beam-geared type," with 66 in. cylinder and 54 in. stroke. The steam pressure was 6 lbs., and consumption of coal 5 lbs. per I.H.P. In the year 1854 Peter Denny wrote: "A great calamity to me took place in the death of my brother, William, aged 39. I was so depressed and disheartened that it needed all the encouragement of my friends in consenting to carry on the business, being so imperfectly qualified as to the technical and practical work, and having the necessity of the commercial department wholly upon myself." The firm also lost James Denny in May, 1862, and the whole control of the firm was left for some years in the hands of Peter. Some time in 1867 he asked Mr. Randolph, of Randolph & Elder, for help with regard to the advantages of compounding the engines, when he was told to find out for himself and pay for it, as Mr. Randolph had done. In 1868 they built and engined the *Batavia* for the Cunard Co., which turned out a complete success.

Iron and Steel Institute.—The annual meeting of this Institute will be held, by kind permission, at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, the 4th and 5th of May, 1899, when the President-elect (Sir William Roberts-Austen, K.C.B.) will deliver his inaugural address; and papers promised by Professor J. O. Arnold, Sheffield, Mr. H. Bauerman, London, Mr. E. Disdier, Bilbao, Messrs. Jeremiah and A. P. Head, London, Baron H. Von Jüptner, Donawitz, Austria, Professor H. Louis, Newcastle-upon-Tyne, Mr. Bertrand S. Summers, Chicago, and Professor Wiborgh, Stockholm, are expected to be read and discussed. The annual dinner of the Institute will be held in the Grand Hall of the Hotel Cecil on May 4th. The autumn meeting of the Institute will be held in Manchester on August 15th, 16th, 17th and 18th.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from February 24th to March 24th, 1899:—

Allden, F. A., engineer to the *Tauranga*, to date March 4th.
Anstey, H. C., engineer to the *Pembroke*, for the *Amphitrite*, to date March 13th.
Apps, W. R., chief engineer to the *Pembroke*, for the *Fortc*, to date March 13th.
Ash, H. G., assistant engineer to the *Vivid*, supernumerary, to date March 18th.
Ayers, R. B., engineer to the *Victory*, for the *Starfish*, to date March 3rd.
Basson, H., engineer to the *Repulse*, to date February 24th.
Beal, W. E., fleet engineer to the *Wildfire*, for Sheerness Reserve, to date February 23rd.
Bingham, P., engineer to the *Victory*, for the *Teazer*, to date March 1st.
Bolton, A. W., engineer to the *Victory*, for the *Violet*, to date March 3rd.
Boyle, J. C. M. (probationary), assistant engineer to the *Warspite*, to date March 28th.
Brown, J., to be engineer, R.N.R.
Chamberlain, E. W., engineer to the *Warspite*, to date March 28th.
Church, P. D., assistant engineer to the *Pembroke*, for the Reserve, undated.
Collingwood, R., acting chief engineer to the *Vivid*, to date February 24th.
Collingwood, R., acting chief engineer to the *Vivid*, additional, to assist chief inspector of machinery in supervision of machinery and boilers in torpedo-boats and destroyers, to date March 9th.
Coomber, T. G., fleet engineer to the *Pembroke*, for the *Dreadnought*, to date February 23rd.
Coomber, T. G., fleet engineer to the *Pembroke*, for the *Northumberland*, to date March 9th.
Crisp, A. S., engineer to the *Centurion*, for the *Whiting*, to date January 7th.
Davis, W. K., engineer to the *Tamar*, for the *Hart*, to date February 21st.
Denbow, W., engineer to the *Pembroke*, for the *Warspite*, to date February 24th
Denbow, W., engineer to the *Warspite*, to date March 28th.
Denny, J. T. H., fleet engineer, has been placed on the retired list of his rank.
Downer, J. M., staff engineer to the *Pembroke*, for the *Dreadnought*, to date March 9th.
Duffell, W. J., engineer to the *Vivid*, for the *Sunfish*, to date February 24th.
England, A. C., to be assistant engineer, R.N.R.
Evans, A. (probationary), assistant engineer to the *Warspite*, to date March 28th.
Graham, W. J., chief engineer to the *Vivid*, for the *Phœbe*, to date March 26th.
Grant, H. W., assistant engineer to the *Royal Oak*, to date February 23rd.
Green, D. P., engineer to the *Royal Sovereign*, for the *Banshee*, to date March 31st.
Guyer, T. S., engineer to the *Victory*, for works of Messrs. Thompson, Glasgow, to take weights, &c. of *Kestrel*, to date March 13th.
Haigh, F. E. P., assistant engineer (temporary) to the *Warspite*, to date March 28th.
Hall, F. M., assistant engineer to the *Vivid*, supernumerary, to date January 21st.
Ham, J. W., engineer to the *Barfleur*, for the *Fame*, to date January 7th.
Hewitt, J. B., engineer to the *Sans Pareil*, to date February 24th.
Hobbs, P., engineer to the *Tamar*, for the *Handy*, undated.
Hockey, S., staff engineer to the *Pembroke*, to assist chief inspector of machinery in supervision of machinery and boilers in torpedo-boats and destroyers, to date March 9th.
Hosken, W. E., engineer to the *Victory*, for the *Vulture*, to date February 24th.
Jackson, E., fleet engineer to the *Galatea*, to date March 1st.
Johnson, C. H. (probationary), assistant engineer to the *Pembroke*, for the *Amphitrite*, to date March 13th.
Jones, C. A., to be assistant engineer R.N.R.
Larg, J. C., fleet engineer to the *Warspite*, to date March 28th.
Mabb, W. J., staff engineer, has been promoted to the rank of fleet engineer in Her Majesty's fleet.
Madge, H. A., engineer to the *Victory*, supernumerary, to date February 27th.
Madge, H. A., engineer to the *Victory*, for the *Boadicea*, to date March 13th.
Matthews, W. H., fleet engineer to the *Victory*, for the *Gibraltar*, to date March 11th.
Maxwell, J., assistant engineer to the *President*, for service at the Admiralty, to date January 14th.
Maxwell, J., assistant engineer to the *Pembroke*, for the *Shearwater*, to date March 20th.
McGregor, W., engineer to the *Victory*, for the *Hornet*, to date March 1st.
Moore, C. A., chief engineer to the *Pembroke*, for the *Brillian*, to date 13th.
Moorshead, J. E., engineer to the *Royal Arthur*, for the *Katoomba*, to date March 4th.
Morcom, W. C., engineer to the *Pembroke*, for the *Contest*, to date March 3rd.
Noll, G. W., chief engineer to the *Pembroke*, for the *Tribune*, to date March 9th.
Peel, H. C. W., chief engineer to the *Sphinx*, on recommissioning, undated.
Picton, A. L. (probationary), assistant engineer to the *Hannibal*, to date March 28th.
Raper, R. St. J., chief engineer to the *Hazard*, to date February 24th.
Ray, H. J., to be assistant engineer, R.N.R.
Read, E. W., to be assistant engineer, R.N.R.
Richards, T. W., assistant engineer to the *Britannia*, to date February 25th.
Richardson, F. M., to be assistant engineer, R.N.R.
Richardson, J., engineer, has been promoted to the rank of senior engineer, R.N.R.
Rock, H. E., assistant engineer to the *Northampton*, to date February 25th.
Roye, J. A., engineer to the *Humber*, to date March 13th.
Russell, C. E., assistant engineer to the *Royal Oak*, to date February 23rd.
Ryan, J., chief engineer to the *Pembroke*, for the *Mersey*, undated.
Shillcock, A. E. (probationary), assistant engineer to the *Royal Oak*, undated.
Short, E. A., chief engineer to the *Victory*, for the *Sharpshooter*, to date March 1st.
Sisley, G. J., assistant engineer to the *Pembroke*, for instruction in engine-room ratings, to date February 25th.
Spence, R., engineer to the *Royal Oak*, undated.
Stansmore, H. C., fleet engineer, has been placed on the Retired List, with permission to assume the rank of Inspector of Machinery.
Stevens, W. C., engineer to the *Pembroke*, for the *Bittern*, undated.
Thomas, E., fleet engineer to the *Royal Oak*, additional, to date February 23rd.
Tilbrook, C. F. H., staff engineer to the *Victory*, additional, to date March 9th.
Westmoreland, F. G., assistant engineer, to be engineer R.N.R.
Williams, H. A., to be assistant engineer R.N.R.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE falling off in fresh bookings by Clyde shipbuilders, which has been noticeable, and has been commented upon during the past two months, is now very pronounced. There have only been two or three contracts reported during March, and these have been, as will be made evident in the course of these notes, comparatively unimportant. This pause in the placing of orders is doubtless partly on account of the inability of builders and engineers to give anything like reasonable delivery, but mainly because of the high level to which prices have risen, and the advances which have had to be conceded in wages. Some owners are credited with being quite ready to place new orders, even at the high figures ruling, if they could only be assured of reasonably quick possession. As things are, however—with all the leading departments in iron, steel, coal, and with marine shops especially, at their wits' end, so to speak, in order to cope with the demands that have flowed in upon them—no assurance of delivery, except under a latitude of months, is forthcoming, and owners therefore naturally prefer to wait, uncommitted, on the course of events.

The cessation in placing orders does not of course sensibly affect the existing activity in the yards and engine shops, nor is it likely to be felt for some time to come owing to the great amount of work still on hand. Nevertheless launches are very plentiful, and the rate of output in this way is far in advance of the rate at which engineers are managing to complete the necessary machinery, in spite of working—as most of the shops are doing—double shifts. In support of this it may be stated that on the 23rd ult. it was computed that in the harbour and docks of Glasgow, from Fairfield upwards, no fewer than 30 vessels, all new, and aggregating over 60,000 tons, were afloat and being engined, or rather awaiting the completion and installation of their machinery. This is certainly a striking indication of the extraordinary brisk state of matters obtaining in Clyde engine shops.

Official intimation has just been given, by the secretary of the Clyde Engineering Employers' Association, that the employers cannot in the meantime concede the advance of wages recently asked by the men. At the meeting of the employers at which this decision was come to, held on the 22nd, the opinion was general that in the circumstances, with the price of material as well as the price of all kinds of labour so high, it would be a mistake to further increase the cost of production, more especially seeing the building berths in the yards were not being filled nearly so fast as they were being emptied. It is expected that the men will accept the decision as concluding the negotiations for the present.

For as much of the month as has passed at the time of writing, the activity in launching on the Clyde has resulted in some 20 vessels, aggregating about 45,000 tons, being consigned to their native element. This may probably be added to, and for the entire month the full tale may reach 50,000 tons, which will constitute a big month's work. To the total, however, a very substantial contribution is made by one vessel alone—the Japanese battleship *Asahi*—whose displacement tonnage when completely equipped will be as much as 15,200 tons. The launch of the ponderous vessel—she being the heaviest warship ever constructed on the Clyde—was most successfully accomplished by the staff at Clydebank, and the spectacle was witnessed by immense crowds of people. Madame Kato, the wife of the Japanese Minister in London, performed the naming ceremony. Besides smashing a bottle of wine against the bow, as the vessel began to move, a pretty Japanese launching custom was observed—a number of pigeons contained in a gaily-tinted, balloon-like cage suspended from the stern, were released, along with a shower of coloured paper, making the scene lively and picturesque.

The *Asahi*, which is the second warship built at Clydebank for the Japanese Government, closely resembles the *Shikishima* launched about four months ago by the Thames Shipbuilding Co., and is a sister ship to the *Asahi*, now building at Elswick. Her length, extreme, is 425 ft. 6 in.; breadth, 75 ft. 2½ in.; and depth, 43 ft. 7½ in. The engines, which will also be supplied by the Clydebank Co., are of the three-cylinder triple-expansion type, and consist of two sets, each of which is expected to develop 7,500 I.H.P., or a total of 15,000 I.H.P. The boilers are of the Belleville water-tube type, with economisers, and twenty-five in number. The speed will be between 18 and 19 knots. When completed, the *Asahi*, undoubtedly, will be one of the most formidable battleships afloat.

On the berth vacated by the *Asahi*, work will at once be proceeded with in laying down the keel of the *Leviathan*, which is to be the name of the armoured cruiser of the class of which three were contracted for about five weeks ago; one also being ordered from Fairfield, and the third from Barrow. These vessels are to be 500 ft. long between perpendiculars, 71 ft. breadth extreme, 26 ft. mean draught, 14,100 tons displacement, 30,000 I.H.P. speed, with natural draught, 23 knots; and are to have twin-screws and Belleville boilers with economisers.

During the month most successful trials have been gone through with a number of the 30-knot torpedo-boat destroyers, in whose successful completion Clydebank has been somewhat tardy. One of these vessels last built, the *Vulture*, on the 8th ult. made three double runs—one with and one against the tide—the mean of which was 30·70 knots. The average speed over three hours' running was 31·18 knots, with a mean I.H.P. of 6,202. The *Kestrel*, another of the Clydebank destroyers, will shortly be put through her official trials with, it is hoped, as great success as in the case of the *Vulture*. The *Leven*, one of the destroyers produced by the Fairfield Co., has also run official trials with most gratifying results. One run over the mile at Skelmorlie was made at the rate of 31·85 knots. The mean speed on three hours' trial was 30·201, the mean I.H.P. being 6,194, and the mean number of revolutions 372·4. Whilst the speed results are highly satisfactory, the result of the coal consumption is even more so, as it worked out at 2·09 lbs. per I.H.P. per hour, which is by far the best ever obtained in a boat of this class. The excellent performance is understood to be attributable to a novel fitting in the furnaces, introduced by Mr. Gracie, the engineering manager at Fairfield.

On the Clyde, as elsewhere nearer the renowned base of the fishing operations of the East Coast—viz., the Humber mouth—the trawler-building industry seems brisker than ever. Not only on the Clyde, but on the Forth, the Tay, and the Dee, these sturdy and speedy little vessels are being turned out in great numbers, and constitute no inconsiderable part of the work on hand. Messrs. Mackie & Thomson, of Govan, on the Clyde, who invariably launch three of these vessels from the same berth on one day, had, during last month as many as 10 trawlers lying within the Princes Dock, Glasgow, being supplied with their engines and deck equipment, and besides these there were three other vessels of this class, built by the Irvine Shipbuilding Co., also in dock, receiving their machinery. Messrs. Muir & Houston, of Kinning Park Engine Works, are supplying engines to the majority of this fleet of trawlers.

Messrs. Mackie & Thomson, Govan, received, about mid-month, an order to build a screw steamer 210 ft. long, and of 1,100 tons deadweight for Messrs. Hawthorn Bros. & Co., London, to be employed in the fruit-carrying trade. Engines will be supplied by Messrs. A. Stephen & Sons, Linthouse, which will be capable of driving the vessel at a speed of 11½ knots.

Messrs. Murdoch & Murray, Port-Glasgow, have contracted to build a twin-screw steamer for passenger and cargo service on the river Amazon, of a similar description to many vessels they have lately built for the same service.

The commission to build and engine a twin-screw steam yacht for the proprietor of the *New York Herald* has been given to Messrs. W. Denny & Bros., Dumbarton, by Messrs. G. L. Watson & Co., Glasgow, the noted designers for sailing and steam yachts. The new vessel will be of considerable tonnage, high speed, and have palatial accommodation. Mr. Watson's firm has recently designed for wealthy American owners, and placed with Clyde builders, several yachts of like size and character, one of which, about 1,800 tons, is now under construction in the yard of Messrs: Scott & Co., of Greenock, for Mr. A. J. Drexel, of Philadelphia. Other vessels to Mr. Watson's design and order are under way in the yard of the Ailsa Shipbuilding Co., Troon, and Messrs. Ramage & Ferguson, Leith, while only a short time has elapsed since the completion by the Fairfield Co. of Baron Rothschild's magnificent steam yacht *Atmah*. Hitherto Messrs. Denny Bros. have not done much in steam yacht building, although of course their numerous productions in the way of swift paddle-steamers for river and channel service are likely to have yielded experience which should be useful in turning out a high-class pleasure yacht of notable speed.

Messrs. Rankin & Blackmore, engineers, Greenock, have contracted to furnish triple-expansion engines for two steamers recently booked by Messrs. Russell & Co., Port-Glasgow, one set being of 2,500 I.H.P., and the other of 1,500 I.H.P.

Mr. Robert Montgomerie, engineer, Greenock, has contracted to construct two sets of engines for Messrs. Ross & Marshall, of Greenock, a firm well known in shipping circles on the Clyde through its extensive lighter and sailing business. Mr. Montgomerie has also contracted to supply engines for the steam yacht at present being built by Messrs. Blackwood & Gordon, Port-Glasgow, to the order of Mr. Joseph W. Russell, founder of the well-known shipbuilding firm of Russell & Co., of the same port.

Messrs. Ross & Marshall, above named, who have now a fleet of lighters, &c., numbering about 40, naturally find the up-keep and repair of their vessels a heavy item of expenditure, and with considerable enterprise they, about a year ago, erected a hauling-up slip as an additional facility to their building and repairing premises, immediately to the west of the shipyard of Messrs. Carmichael, Maclean & Co. The slip, which was laid down entirely by the firm's own workmen, is 600 ft. in length, and is capable of taking on vessels having a draught up to 20 ft. In addition to the slip the premises embrace accommodation and facilities connected with every department necessary in the building and repair of ships and engines. Messrs. Ross and Marshall are continually offered work by outsiders, but with their large and increasing business they find that they have quite enough to do in meeting their own needs. Amongst the vessels they have recently turned out for themselves are the *Southern Light* and the *Lucullite*. At the present time they are building a similar craft to the last-named, and are making alterations in the well-known steam launch *Medusa*, which belonged to Mr. Murray, of the *Challenger* Expedition. This vessel is being fitted with twin-screws, and otherwise fitted to take part in salvage operations.

In last month's notes reference was briefly made to the fact of bilge keels being then fitted to the Allan liner *State of Nebraska*, and it is of interest to chronicle the fact that two more instances of these important adjuncts being provided for notable transatlantic liners are furnished in the cases of the American liners *St. Louis* and *St. Paul*. On the 22nd ult. a considerable body of operatives left the Clydebank shipyard for Southampton in the large graving dock, at which port they will fit bilge keels to the first of these vessels, and eventually to the other boat.

The employees of Messrs. Hall-Brown, Buttery & Co., St. Helen's Engine Works, Govan, held their annual festival recently, completely filling the Queen's Rooms, Glasgow. Mr. E. Hall-Brown presided, and was supported by many of the Clyde shipbuilders, engineers, and marine superintendents. In presiding over such a splendid assembly, the chairman assured them, amongst other things, that he looked upon them all as real partners of the firm in the best sense of the word. The firm, it may be stated, has at present on hand a large number of sets of marine engines, amongst which is the largest order the firm have yet undertaken. This is a set of triple expansion engines of 2,500 I.H.P., intended for a steamer now being built by Messrs. R. Duncan & Co., Port Glasgow. The orders at present on hand reach the respectable total of 21, the total since the firm's inception in 1892 being 68 sets of engines. In the year stated they took over the engine works previously carried on by Mr. William Kemp. Having entirely re-organised the works, and added considerably to the plant, the output during the first year was nine engines with an I.H.P. of 1,750. Last year the output was also nine engines, but the I.H.P. rose to 12,045. Finding that their facilities for the expeditious delivery of the numerous heavy orders now entrusted to them were becoming insufficient, the firm last year erected an extension of the engine-shop, that more than doubled their floor space, and they also added a 45-ton steam travelling crane. They also built a complete range of offices, and considerably added to their staff. Mr. E. Hall-Brown, it may be added, received his engineering training in the Fairfield Engineering Works, where he was employed for nine years—the last four in the drawing office—and afterwards was with Messrs. T. Richardson & Sons, West Hartlepool, where for several years he was head of the scientific department, and was entirely responsible for the designs of all the engines turned out. This position he resigned, and joined with Mr. John A. Buttery in the present firm. Mr. Buttery is the son of Mr. John Buttery, of Penang and Singapore, and received his engineering training in the Park Locomotive Works, Glasgow.

The Grangemouth Dockyard Co., at Grangemouth on the Forth, have booked an order for, and are now laying the keel of, a four-masted sailing barquentine for Nova Scotia ownership, similar to one they built for the same owners two years ago, but of greater deadweight. The vessel will be employed in the lumber trade. This is about the only instance of a sailing ship being at present under construction in Scotland. The Dockyard Co. have also received an order from Messrs. Tatham Bromage & Co., for the repeat of a 1,100 ton steamer just finished, and which has been sold to German owners.

Speaking at the annual festival of the Dundee branch of the Boilermakers and Iron Shipbuilding Society held early in the month in the Kinnaird Hall—the largest place of assembly in Dundee, Mr. W. S. Jackson, manager of Camperdown Shipyard, who occupied the chair, referred at the outset of an interesting address to the prosperous state of the Dundee shipbuilding and boilermaking trades. At the present time, and for some little time past, both branches of industry were in a condition of exceptional activity. Wages had never been so high as now, and this showed that the workmen had the ball at their feet. They should therefore make the best of their opportunity. The existing boom, however, he feared was on the turn, and while all regretted this, they—the practical operatives in shipbuilding and boilermaking—must all admit that such good times as they had been experiencing could not be expected to last for ever. The workmen, he asserted, had had the best of the spurt, because prices had not come up with the demand, but he hoped the poor employers would get a share in the near future. Adverting to the Dundee branches of the society, Mr. Jackson said the income of the branches for the year was £1,678 3s. 11d., and the expenditure £679 16s. 10d., leaving a balance of £998 7s. 1d. He concluded by advising the men to make the best possible use of their present opportunities and lay by part of their high wages against a rainy day.

Dundee's early example of a steam engine by James Watt, till recently located at work in one of the public works of Dundee, but acquired as a memorial and example of old-time engineering by public enterprise, is now about to be housed and set up in the Barrick Building, where it will be in a situation well adapted to its preservation and to free inspection of all interested. The cost of housing and erecting the engine will amount to £500, and the fitting up will be done in such a way as to admit of electric motor power being applied for putting it in motion if at any time desired.

Mr. F. W. Paul, who has for some years been the manager of the Blochairn Works of the Steel Company of Scotland, has been appointed to a similar post at the Shelton Bar Iron and Steel Works, near Stoke-upon-Trent. Mr. Paul's experience has hitherto been connected with the making of steel by the Siemens open hearth process, but in his new post he will have to work by the Basic-Bessemer process, the raw material to be dealt with being North Staffordshire pig-iron. Before going to the Blochairn Works Mr. Paul had charge of the furnace or melting department of the Newton Works of the Steel Company. Mr. Paul has, since its foundation, been a prominent member—and latterly the President—of the West of Scotland Iron and Steel Institute. In discharging the duties of the presidentship he acquitted himself very much to his own credit and to the success of the Institute.

The unanimous re-election of Mr. T. C. Guthrie, of Messrs. Guthrie, Macdonald, Hood & Co., as representative of the Clyde Sailing Shipowners' Association on Lloyd's Register Committee until July, 1903, has given much satisfaction, not only to all interested in shipping affairs on the Clyde, but also to those who furnish materials of which ships are built. The steel makers of the West of Scotland have not forgotten that it was largely owing to Mr. Guthrie's exertions that Lloyd's Committee were enabled to find it possible to reduce the fees for the steel testing required to be done at the steel works, and this reduction has since saved the steel makers considerable sums annually.

Mr. George M. Shaw, who has been 12 years in the employ of Messrs. Ramage & Ferguson, Leith, lately as chief draughtsman in the shipyard drawing office, has been appointed to the surveying staff of Lloyd's Register. On the evening of March 1st the foreman and officials of Messrs. Ramage & Ferguson met in a social capacity, and presented Mr. Shaw with a handsome solid silver salver, bearing a suitable inscription.

The difficulty which ships' officers often experience in determining when a vessel is loaded down to her Plimsoll mark, and no more, and the troublesome, not to say vexatious, circumstances which not infrequently arise through a misjudgment as to how a vessel is situated with respect to her marks, especially where there is anything of a list, are matters which have led Mr. David Smail, of Glasgow, to devise an instrument by which accurate and ready note may be taken of the position of the water relatively to Plimsoll mark as loading proceeds. The device takes the form of a plate with a slot in the centre, and a full-sized Plimsoll marked on it, which is fixed on to the rail on deck. From it hangs a weighted float on a wire, and at the inner end there is an equal weight with an indicator. A glance at the indicator will always show accurately how the loading of a vessel is proceeding, and with it the unintentional overloading, which is a fruitful source of worry, will be impossible. With a list which often upsets calculations there could be as little chance of error, as the mean would be the true draught of the ship. The apparatus, which is cheap, portable, easily fixed, and only necessary in the later stages of loading, has been tried for six months on a vessel, and has answered admirably.

THE TYNE.

(From our own Correspondent.)

Shipbuilding.—Though shipbuilders have orders in hand sufficient to keep their machinery going throughout the year, and in some cases even for a longer period, it begins to be apparent that the tide of prosperity has reached the highest point, and that the next change will be in the direction of lessened pressure. As was stated in last month's Notes, few contracts have been placed since the advent of the new year, and now we hear that enquiries have noticeably lessened in number. This has probably been caused by the shrinkage that has taken place in rates of freight, which has served to remind shipowners that expansion is a process that cannot go on indefinitely. The reverse process is now unpleasantly obtruding itself on public notice, and hence the slight check that appears to have been given to speculative enterprise in shipbuilding. The rush of business which came to all the centres of the industry last year has had the effect of inducing firms engaged in the manufacture of steel plates and angles, as also stern frames and other forgings to enlarge their works with the view of increasing production, and in connection with the latter branch of business, several new ventures have been started. All this has been done because it was seen that existing resources were inadequate to meet the demand that had arisen. It is to be feared, however, that in many cases the developments have been made too late to admit of any large participation in the present run of prosperity, on the part of the firms concerned. It seems a truism that the best time to make extensions, or to lay down new works, is during a term of slackness, for then everything can be done at the minimum of cost, and the place is ready for operations when trade takes the upward turn which invariably succeeds depression.

Four Tynside firms have been invited by the Admiralty to tender for the construction of one or two cruisers of the *Diadem* class (440 ft. long), and we are pleased to note that among them is the enterprising firm of Messrs. C. S. Swan & Hunter, who, we believe, have not tendered for Government work hitherto, or at all events, have not executed any contracts of that description. It is much to be desired that this firm should get a share of the forthcoming work, as they have made an enviable reputation in every other department of shipbuilding, and will, no doubt—should the opportunity be afforded—make themselves an equal title to distinction in this. They possess, indeed, an advantage which no other firm in the kingdom can boast, namely, the capacity to build under cover; and in connection with the construction of warships, this ought to be a feature of very considerable importance.

Messrs. Armstrong, Whitworth & Co., are laying out new berths at their Elswick yard, and it is anticipated that in the course of the summer months, the additional building accommodation, as well as that already provided, will be fully utilised. The initiatory departments are at present very busy; but at this moment there is not much doing in the fitting out of vessels, there being only two (one of which is a Brazilian transport ship) now moored at the quay. The company's Low Walker yard continues to be full of work, all the vessels in hand being of large size, and intended for special trades. Additions to the plant are still being made, and the establishment is being brought thoroughly up-to-date as a shipbuilding yard. The company, it may be added, are amongst the firms that have been invited to tender for the new cruisers; but it is questionable whether they will avail themselves of the privilege, as they have an exceptionally large amount of mercantile work in hand, besides warships for foreign powers.

The Palmer's Co. are tendering for the Government work, and are likely to be amongst the successful competitors. The work they have hitherto turned out to the order of the Admiralty, has been most satisfactory, and as the officials of the company have special experience in this department of naval architecture, it would be strange if the company's strong claims to the favour of the Admiralty authorities, should be ignored. A very full share of mercantile work is to be seen on the stocks, however, and even if the company should fail in securing a part of the present Government programme, there is no likelihood of any lack of work taking place in their yard during the current twelve months.

Messrs. Wigham Richardson & Co. launched on the 11th ult. a very handsome steamer, ordered by the Cork Steamship Company for their Continental service. This is the fifth or *sixth time* that this prosperous Irish shipping company have come to Messrs. Wigham Richardson to get their requirements fulfilled, and the circumstance reflects much credit on this well-known firm of shipbuilders. Messrs. Hawthorn, Leslie & Co. have also launched a vessel during the month, and have another well advanced towards completion. The vessel launched was the s.s. *Kent*, a meat-boat 435 ft. long, ordered by Messrs. Wm. Milburn & Co., London. She is now at the St. Peter's Works receiving her machinery, and will soon be ready for sea. Messrs. Robert Stephenson & Co. have a fair quantity of work in hand at their Hebburn yard, and could doubtless have much more but for the circumstance that a considerable portion of their extensive yard is still occupied by the large Spanish pontoon, ordered two or three years ago, and long since completed. On account of the complications that have arisen in Spanish political affairs, however, no attempt has yet been made to disintegrate the pontoon for shipment, although it is understood that a port for its location in Spain has been selected.

The Tyne Shipbuilding Co. are still exceedingly busy, and at Messrs. Readhead's yard a full occupation of the building berths is still to be noticed. Messrs. Dobson, and Messrs. Wood & Skinner, are also well off for work, and the latter firm have just delivered to the owners, Messrs. F. Strick & Co., of London, a very fine and well-equipped cargo boat over 300 ft. in length.

In the repairing establishments business is just now exceptionally brisk, there being a large number of vessels getting overhauled, and having their equipments of auxiliary machinery &c., brought up to date. It is expected that business in the repairing line, will further improve shortly, when vessels which are usually engaged in the summer tourist service, are placed in the repairers' hands to be got ready for the coming season.

Messrs. The Smith's Dock Co., Ltd., having no room for further extensions at North Shields, have purchased a site 88 acres in extent at Jarrow Slake, which they mean to utilise, probably for the location of a pontoon dock, and the erection of necessary adjuncts in the shape of machine shops, shearlegs, &c. Jarrow Slake is a flat area between Jarrow and Tyne Dock, which is wholly covered with water at high tide, and is partially submerged at low tide. It has hitherto been largely occupied by timber rafts, and as a mooring place for vessels to be broken up; and the news that it is now to be devoted to more ambitious purposes, has caused much satisfaction at both the centres named.

Engineering.—There is a feeling in some quarters that trouble is likely to arise between the employers and the operative engineers in reference to the wages question. It is known that an advance has been asked for, though at the moment little is being said about it. No one imagines, however, that the matter is going to be dropped without an effort being made on behalf of the workmen to get the desired concession granted. There does not appear to be much discontent amongst the men as regards the wages rates, which are now at the highest point ever reached in the history of the trade, and it is shrewdly suspected that the application referred to has been put forward by a few officious leaders without the aid of any pressure from the rank and file.

The employers do not appear to have considered the matter very much as yet; but it is highly probable that should the claim for an advance be persisted in it will be refused, and the employers will doubtless be able to show good reasons for declining to give an advance under present circumstances. Meantime, work in the shops goes on very briskly, the locomotive establishments being fully as busy as the works in which marine engine building is solely carried on. As in shipbuilding, however, few new orders are being placed, and what with night shift in some departments, and overtime in others, the contracts in hand are being very rapidly got through.

Messrs. Noble & Lund, of the Felling Machine Tool Works, have numerous orders in hand for their various specialities, and great activity continues to exist in all their departments. Since the completion of their large foundry, their business has further increased, as owing to the circumstance of being able to make their own castings, they have been in a position to meet the requirements of customers with greater promptitude.

Messrs. Donkin & Co. (late Donkin & Nichol) of the St. Andrew's Engine Works, Newcastle, are well supplied with orders for steering gears, engine-room telegraphs, ash hoists, and other specialities; and in all departments of their works business continues active.

The Zynkara Co. Limited (proprietors of the well-known composition for the prevention of corrosion in boilers), continue to experience a large demand for their speciality, and we understand they are contemplating a further extension of productive resources.

The "Octopus" Lubricator Co., Limited, of which Mr. W. J. Stephens is managing director, have taken offices at No. 7 Side, where the business of the company will henceforward be carried on. This appliance is applicable to both land and marine engines, and possesses the unique quality of exactly adjusting the supply of oil to the requirements of each working part. In many other important particulars it is distinguished from other lubricating appliances, and it is significant that up to the present time 17,000 have been fitted.

Mr. George Noble, consulting engineer of 7, Dean Street, Newcastle, has appointed Mr. Joseph Johnson, 1st class engineer as his assistant. Mr. Noble, we may state, is the representative in the North Eastern counties of Messrs. Charles Cammell & Co., Sheffield.

Messrs. Isdale & Farrow, of 4, St. Nicholas Buildings, Newcastle, have been appointed sole agents in the Tyne and Wear districts for the newly-established Clydeside Tube Co., Limited, Glasgow, and have issued a circular stating that their principals are now in a position to accept orders for delivery in May. These new works cover an area of 20 acres, and are equipped in a thoroughly up-to-date manner. The managing directors are Mr. John Wotherspoon and Mr. W. S. Brown, both of whom have had a long connection with the tube-making industry.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—Messrs. Doxford launched another *Clan* steamer this month, and we believe there are two others to follow in the course of the year. One of the vessels now in the stocks is for Messrs Johnson, of Liverpool, and we are informed that the vessel ordered by the Peninsular and Oriental Company is to be put down in the berth now occupied by a vessel in the framing stage. This vessel will probably be ready for launching in May, and it may be presumed that no time will then be lost in proceeding with the laying down of the P. and O. Company's boat. We hear that another local firm of the first importance has adopted the "joggle-plating" system introduced by Messrs. Doxford some four years ago, and which has been almost as remarkable a success as their other notable invention the "turret" design. It is now pretty generally admitted that the universal adoption of this system is but a question of time.

Messrs. Short Brothers are further increasing their working facilities by the erection of a number of derrick cranes to hoist material to any part of each vessel under construction. In addition to the new work in hand, the firm are now engaged on an important repair contract.

The Sunderland Shipbuilding Company, who recently launched a finely-designed and exceptionally large vessel for Messrs. Jenkins & Co., of London, are understood to have received another order from the same owners. Their close neighbours, Messrs. Bartram & Sons, have a large vessel nearly completed for Messrs. Pinkney, Sunderland, and others in less advanced stages for owners at distant ports.

Messrs. J. L. Thompson & Sons continue to be busy on new vessels of an important class, and have also a considerable amount of repair work in hand. At Messrs. Blumer's, and also at the Strand Shipbuilding Co.'s yard, the work in progress is sufficient to keep the machinery going full.

Engineering.—The marine engine works continue to be as busy as possible, and at the smaller establishments the pressure of work is also very great. A new forge has been started at Southwick, and another establishment of the same kind is being got ready for a commencement of operations at Pallion.

The Sunderland Forge and Engineering Co., Limited, are exceedingly busy in both the electrical and forging departments. In the former there is just now in progress a contract of exceptional interest—this being the manufacture of electric motors and other accessories for Messrs. Austin & Sons, who are about to substitute electrical for steam power in driving the machinery in their shipbuilding yard. Only a limited number of shipbuilding firms have as yet adopted electricity as a motive power in their shops, but the principle is receiving more attention daily, and is evidently gaining in public favour. There is also in hand a number of contracts for electric cranes, which the firm have made a speciality; and they are besides doing a large business in ship-lighting. An important extension is now being made in connection with the forge department, this being the erection of a machinery shed which covers an extensive area, and is intended for the finishing of heavy work. A new steam hammer of the heaviest class is being put down, and other important additions to the existing plant are being made. There are at present in hand a number of exceedingly massive stern frames, ranging from 10 to 14 tons, for local firms, and one of 16 tons weight for Sir Raylton Dixon & Co., Middlesbro'. A special feature is made at this forge of the manufacture of single plate-built rudders, and a number of these are now in hand for ships in course of construction. The extensions are expected to very largely increase the productive capacity, and allow of even greater promptitude in delivery than has hitherto been attained.

The Hartlepools.—Messrs. Wm. Gray & Co. have launched a second vessel of the type known as the "Patent Side Ballast Tank," for which many advantages of an important kind are claimed. Among these may be mentioned the lessening of the tendency to roll, and the prevention of "racing" of the machinery. It remains to be seen whether the type will become popular; but in fairness, it must be said that the first vessel of this design built, has undergone the test of a rather long voyage in heavy weather, in a remarkably satisfactory manner. The whole of Messrs. Gray & Co.'s building accommodation is being utilised, and at the other Hartlepool yards business is as active as could be wished. Messrs. Richardson's engineering works are still showing great briskness, the electrical departments being as fully engaged as the older departments of the works. In the forge there are a number of important contracts in hand, and the section that has been specially set apart for the construction of auxiliary machinery, is kept in active operation. At the docks business is now quite dull, owing to the absence of timber importations. In two or three months from now, however, the state of business in the timber trade will be as brisk as ever.

Stockton.—There is still a plenitude of work in the shipyards, and at all the establishments night work in the frame-turning departments is continued. Messrs. Craig, Taylor & Co., are pushing on their important work of extension, and are ordering new plant for the equipment of the additional premises to be erected. Boilermaking establishments are extremely busy, and find it difficult to meet the requirements of customers. A new method of constructing donkey-boilers of the marine type, has come into use, which has the twofold effect of minimising labour and accelerating production. The method is to use but one plate for the circumference of the shell, thus making only one joint to be strapped and rivetted. The ends are formed of two flanged plates as hitherto, three plates forming the whole shell of the boiler. There is, we believe, no patent in the principle. and most of the boiler manufacturers are resorting to this method of construction, whenever it is permissable.

Middlesbro'.—Shipbuilding firms at this centre have their full share of work, and engineering establishments are equally well situated. Steel works are exceedingly active, and foundries, as also bridge works and boiler works, are showing a similar state of prosperity.

Darlington.—The works of the Darlington Forge Co. continue in full activity, and other works are fairly well employed.

THE MERSEY.

(From our own Correspondent.)

PRESSURE of work both on account of orders already on the books and new orders coming forward continues the report throughout all branches of the marine and general engineering and shipbuilding industries of this district. The leading machine tool makers are mostly in the position that they cannot entertain new work to be put in hand much before the close of the year, and in some exceptional cases they are compelled to decline more new orders than they are able to accept, whilst generally work is coming forward in excess of contracts running out. There is, consequently, every prospect of full activity for a considerable time ahead, and under these conditions there is a steady hardening up in prices. In all other sections of engineering the position is very much the same, locomotive builders, who have been booking a considerable weight of new work recently, having orders to carry them well over next year. Boilermakers are also exceptionally full of work, and hydraulic and electrical engineers are all excessively busy.

The monthly returns issued by the engineering trade unions continue of a very satisfactory character. The Steam Engine Makers' Society has only 1 per cent. of its total membership on donation benefit, whilst in Manchester, Bolton, and Oldham practically a clear book is reported. The difficulty with this society is, in fact, to supply men to meet the requirements of the employers, and many applications from the latter have to be declined. The United Machine Workers' Association has not more than 2¾ per cent. of the total membership on benefit, and in Manchester the proportion is under 2 per cent., whilst at Sheffield, Belfast, Gateshead, Glasgow, Barrow-in-Furness, Birkenhead, Doncaster, Huddersfield, Grantham, Halifax, Ashton-under-Lyne, Lancaster, Crewe, Gloucester, Newcastle-on-Tyne, Wigan, Edinburgh, Woolwich, Erith, Loughborough, and Grimsby there are no unemployed members. The wages question at Bolton and Blackburn, where the men have asked for an advance of 2s per week, is still pending. Out of fifty branches, twenty-nine return trade as "good," and the remainder as "fair."

On Saturday, the 11th March, Messrs. Laird Bros. floated from their building dock at Birkenhead, H.M. battleship *Glory*, which is the third warship constructed by this firm for the home navy within a period of ten years. Particulars of this vessel and its floating will be found in another column. The firm have also in hand the *Express* and *Orwell*, now undergoing their steam trials; two twin single-screw sloops, H.M.S. *Mutine* and *Rinaldo*, of 980 tons and 1,400 H.P.; a 30-knot destroyer for the Russian Government, which will shortly be ready for launching; a paddle-wheel steamer, launched in February, for the South-Eastern Railway Company's Folkestone and Boulogne traffic; a first-class battleship for H.M. Navy of 15,000 tons, and 18,000 I.H.P., to be named the *Exmouth*, is to be laid down immediately in the building dock just vacated by the *Glory*. There are also in progress a set of twin-screw engines of 15,000 H.P. for H.M.S. *Implacable*, which is building at Devonport, and a set of water-tube boilers for H.M.S. *Blanche*, to replace her original locomotive boilers.

In our last notes reference was made to the important extensions now in progress at the Manchester works of Sir William Armstrong, Whitworth & Co., Limited. These extensions, which include large additions to the ordnance department, and an entirely new range of shops for the manufacture of armour plates, are being rapidly pushed forward, and several of the shops are now in an advanced state. When completed they will be an important addition to the industrial enterprise of the district.

Messrs. B. & S. Massey, of Manchester, have recently supplied several sets of steam hammers specially designed for fastening the tyres of railway wheels after they have been put on the axle, the hammer being so constructed that they can operate between the two wheels. The firm have also just supplied to an English manufacturing firm one of the largest steam stamps which has hitherto been constructed, this being made for 20 cwt.; the largest stamps of this type previously made have not been more than 15 cwt.

An exceptionally large gas engine has just been completed by Messrs. Crossley Brothers, Limited, of Manchester. This engine is capable of giving a brake H.P. of more than 400, and is of the firm's special type. Messrs. Crossley have recently taken out a number of new patents, and have revised their designs in many ways, with the result that they have succeeded in reducing the consumption of gas in their latest patterns by more than ten per cent.

An important event during the ensuing year is the autumn meeting of the Iron and Steel Institute, which is to be held in Manchester, and as it is twelve years since the Institute last visited the above city, very considerable interest is being taken in the matter, and everything promises that the proceedings will be of a very successful character. Already a big representative local committee has been appointed, with Mr. S. R. Platt, of Oldham, as Chairman, Mr. Henry Webb, of Bury, as Vice-Chairman, and Mr. Thomas Ashbury, C.E., of Manchester, as Secretary, and the preliminary arrangements are being rapidly pushed forward.

The Railways Regulation Bill, so far as it proposes to introduce the compulsory adoption of automatic couplings, is meeting with the very strongest possible opposition from all sections of the coal trade and waggon-building industry in this district, and the contention is that this proposal has been brought forward without adequate consideration, and that even taking American statistics, where compulsory couplings are in operation, the loss of life is larger than on English railways where this arrangement has not so far been adopted.

During the past month there has been a quietening down, so far as new business is concerned, in the iron trade here. Large users are mostly well covered, and holding back from placing further orders, and transactions have been chiefly through merchants at under the current rates. Makers, however, are generally well booked, and indifferent about selling just now, and show no giving way on their basis quotations. Lancashire foundry is firm at 55s. 6d. less 2½, with Lincolnshire 53s. net, and Derbyshire 54s. to 55s. net cash delivered Manchester. Forge qualities maintain a strong tone and the general average is about 52s. 6d. less 2½ for Lancashire, and 5½ net cash for Lincolnshire, delivered Warrington. Outside brands have been very irregular, owing to the fluctuations in warrants, and the average rates show a giving way on last month's prices. Good foundry Middlesbro' ranges from about 56s. 4d. to 56s. 10d. net by rail Manchester, with Scotch iron at Manchester Docks about 59s. for Glengarnock, and 59s. 6d. for Eglinton, and ordinary foundry American pig iron about 55s. to 56s. net.

With regard to finished iron, although makers are well booked, bars are in less active request, with £6 15s. to £6 17s. 6d. the average for Lancashire, and £7 for Yorkshire and North Staffordshire qualities, delivered here. Sheets remain at about £7 15s. to £7 17s. 6d. Hoops are in steady demand at the Association list rates of £7 for random to £7 5s. for special cut lengths delivered Manchester district, and 2s. 6d. less for shipment.

The steel trade has scarcely fully maintained the strong tone recently reported. Makers still quote 69s. to 70s., less 2½, for No. 3 foundry hematites, but there has been underselling in the open market. Local made billets are quoted £5 net. In steel bars of the large sizes there have been sellers at £7 5s., with, however, general quotations £7 10s. to £7 15s. In common steel plates makers ask £7 15s. to £7 17s. 6d., but considerably under these figures has been taken in special cases. Steel boiler plates average about £8 12s. 6d. delivered in this district.

In the metal market business has been only of limited weight; and with the close of the month the downward move in raw material has been followed by a reduction in list rates for manufactured goods to the extent of ½d. per lb. on brazed brass tubes, rolled metals and wire. Delivered Manchester district basis rates are now as under:—Solid drawn brass tubes, 8¾d.; copper tubes, 11d.; brazed copper gas and steam tubes, 10¾d.; brazed brass tubes, 9¼d.; rolled brass, 7¾d.; brass wire, 8d.; copper wire, 9½d. per lb.

Business in the timber trade has been fairly satisfactory. The arrivals have been moderate, and as the deliveries of most articles have exceeded the imports, stocks, with the exception of a few items, are considerably reduced, and values steady; contracting for next season has not been brisk, but some headway has been made. The arrivals of teak squares have been very moderate; stocks are not heavy, and there is rather more enquiry, with prices firm. Planks have been coming in more freely, but there is a good demand, and stocks are not large, with values steady. There has been no importation of greenheart, but stocks are sufficient; prices are firm.

A strong healthy tone prevails in the coal trade here. The demand for house-fire qualities is keeping up exceptionally well for the time of the year, and the output is moving away, with prices firm at full list rates. Steam and forge coals are in brisk request, and strong at late quotations. At the pit mouth best Wigan Arley average 12s. to 12s. 6d.; Pemberton four ft., and seconds, Arley 10s. 6d. to 11s.; common house coal, 9s. 6d. to 10s.; and steam and forge coal, 8s. 6d. to 9s. per ton. With regard to forward contracts for gas and steam coal and locomotive fuel, it is not improbable that colliery owners will hold out for an advance of 1s. 6d. to 2s. on gas coal contracts over the rates taken last year, whilst advances of 1s. 6d. on locomotive fuel and about 1s. to 1s. 6d. per ton on steam coal contracts for shipment have been practically decided upon by local colliery owners. Engine fuel is in continued pressing demand, with rather a scarcity of supplies, and prices, which are being advanced in some cases with opening of the month, generally steady at 4s. 9d. to 5s. for common, 5s. 3d. to 5s. 9d. for medium, and 6s. to 6s. 6d. for best sorts at the pit mouth. Collieries are also holding out for a further advance on current rates for forward contracts for engine fuel.

For shipment inquiry has been fairly brisk, with ordinary steam coal fetching 9s. 6d., delivered at the Garston Docks; 10s. delivered High Level, Liverpool, and about the same figures [for delivery at the Partington tips, Manchester Ship Canal.

THAMES.

(*From our own Correspondent.*)

THE finding of the Board of Trade as a result of its investigation into the Barking explosion has now been published, and it cuts very deep since it places the whole blame on the firm. The Commissioners appointed were Mr. Howard Smith, barrister-at-law, and Mr. J. H. Hallett, consulting engineer. Mr. Gough appeared for the Board of Trade, and Mr. Digby Koe for Messrs. Hewett. Mr. Gough said the boiler was 9 ft. 6 in. in height by 10 ft. diameter, and constructed to work at a pressure of 75 lbs. per square inch. After being taken out of the precursor in 1890 it lay at Messrs. Hewett's works until 1892. It was then overhauled, repaired, and tested to 180 lbs., and then fixed to drive the works at 60 lbs. pressure. The firm owned about 180 fishing vessels, of which 28 were steamers. They did not employ a consulting engineer, and the managing director, who was not an engineer, appointed the managers of the works. Mr. Hugh Hallett, a naval architect, was manager, but he resigned in 1898, and Mr. Gordon was appointed in his place. Mr. Holt was boiler maker. Several firms supplied the works with steam gauges, and no record was kept as to whom gauges were sent for repairs, and so they were unable to ascertain when and by whom the steam gauge which was on the boiler at the time of the explosion was overhauled or tested. At Barking part of the verdict was: "The jury are of opinion that all boilers should be independently examined by a qualified inspector at stated periods, and they request the Coroner to forward this recommendation to the Board of Trade." The experts had all agreed that the explosion was due to over-pressure and greatly in excess of the 16 lbs. shown by the gauge. They concluded that one valve was loaded to 243 lbs. and the other to 257 lbs. per square inch. Mr. Howard Smith pointed out that Mr. Hallett did not possess the necessary qualifications and was unable to exercise proper supervision and control. He fixed a working pressure for the boiler which he was incompetent to fix, and he neglected to provide that a washer or ferrule was placed under each compressing nut, so as to prevent the nuts being further screwed down after the adjustment of the safety valves. It was clear the valves had not been properly adjusted in 1897, or else if the valves had been screwed down until there was only a weight of 70 lbs. on each, then 3½ turns would have produced a pressure of 180 lbs. on one and 189 lbs. on the other, instead of about 242 lbs. and 257 lbs. This fact showed what resulted from the absence of proper supervision and control. Mr. Burness, the fitter in charge, who was killed, had the qualifications and experience necessary to adjust the safety valves. Having been told to adjust a valve which had originally been set at 70 lbs., at 60 lbs. per square inch, his proper proceeding would have been to have slackened back the compression nuts, which he told Mr. Gordon he had done, instead of which he screwed them down 3½ turns when there was steam in the boiler. The Court had to state that neither Mr. R. M. Hewett, nor Mr. Donald Gordon, nor Mr. Henry Holt were to blame for the explosion, but that the firm of Messrs. Hewett and Co., Limited, were to blame for their neglect to appoint properly qualified managers for their works, which neglect conduced to the explosion, and they must be held responsible for the negligence of their servant, the late Mr. Burness, who was the direct cause of it. Messrs. Hewett & Co. had to pay half the costs of the enquiry, £125.

Another set of engines, this time for H.M.S. *Pomone*, by Messrs. John Penn & Sons have been under trial. The boilers are the same as those fitted in the sister ship *Pactolus*, and the improvements made in those were also made in those later. The first trial was with a water draught of 12 ft. forward and 15 ft. aft, and for thirty hours' coal consumption at 3,500 H.P.; the steam pressure was 242 lbs., the air pressure in the stokeholds ·88 in. of water; the engines making 173·7 and 172·6 revolutions a minute for starboard and port, and developing 1,798 and 1,811 I.H.P., or a total of 3,609; the mean vacuum was 25 in. and speed 16½ knots an hour. Consumption of coal 2·45 lbs. per I.H.P. On her eight-hour natural draught trial: steam pressure 220 lbs. per square inch; air pressure 1·4 in., and starboard and port engines making 198·3 and 203·6 revolutions per minute, the I.H.P. 5,617, the speed was 20 knots an hour. The result of her full power trial was with 252 lbs. per square in. steam pressure, and air pressure 2·77 in. with revolution 219·6 and 221 per minute, and the I.H.P. 7,340, the speed was 21·5 knots an hour. This is the record speed on a trial of this class of vessel, and it speaks well for the Blechynden boiler and Messrs. Penn & Sons' engineers.

Messrs. John Penn & Sons have also constructed the engines for H.M.S. *Goliath*. She has to have a contract speed of 18½ knots an hour. Her dimensions are: 390 ft. in length, 74 ft. beam, and loaded displacement 13,000 tons, her mean draught being 26 ft. She has twin-screws of 16 ft. 9 in. diameter, driven by two independent sets of three inverted cylinders, triple-expansion engines of 13,500 I.H.P.; the cylinders are 30 in. 49 in. and 80 in. diameter, stroke 4 ft. 3 in., piston steam valves to the high and intermediate pressure cylinders, and double-ported flat slide valves to the low pressure cylinders. Each cylinder is supported in a cast-iron column and two round forged steel columns at the front. The crank shafts are hollow steel forgings 16½ diameter in the bearings, the condenser for each engine has a cooling surface of 7,250 square feet, the circulating pumps of the centrifugal type of 3 ft. 6 in. diameter. The cylinders are steam-jacketed. The tunnel and propeller shafts are of compressed steel, and the thrust blocks have horse-shoe collars lined with white metal. The screw is four-bladed, the boss of gun-metal and the blades of manganese bronze, which are adjustable for pitches between 19 ft. and 21 ft.

There are twenty Belleville boilers, fifteen with nine elements and five of eight elements with 4½ in. tubes; each boiler has an economiser, ten of them having six and ten with seven elements of 2¾ in. tubes. The feed-water will be delivered to the boilers at temperatures ranging between 240 deg. to 250 deg. Fahr. The total grate surfaces is 1,050 square feet, and the heating surface 33,781 square feet, the working pressure being 301 lbs. per square inch, which will be reduced at the engines to 250 lbs.

BELFAST.

(*From our own Correspondent.*)

WE have but two launches from Belfast shipbuilding yards to chronicle this month. The first, which took place from Messrs. Harland & Wolff's yard on 13th March, was that of the steamer *Winifredian*, which has been built for Messrs. Frederick Leyland & Co.'s Atlantic passenger and cattle service. The new vessel is 552 ft. long by 59 ft. beam, and her gross tonnage is about 10,560. At the launching of the vessel quite an unusual ceremony at the Queen's Island took place, and accordingly more than ordinary interest was manifested on the occasion, on account of the ship being christened before leaving the ways by Miss Martin, daughter of the general manager of the company. The *Winifredian* will also be engined by her builders with triple-expansion engines of their usual type, and will be fitted throughout with electric light, as well as all the most approved appliances for expeditiously handling ship and cargo.

On the 16th of March, Messrs. Workman, Clark & Co., Limited, launched from their South yard the steel screw steamer *Brisgavia*. This vessel is 450 ft. long, 53 ft. beam, 34 ft. 5 in. depth moulded, and is classed 100 A.1. to Lloyd's requirements. She is rigged as a two-masted schooner, and has a poop, long bridge and top-gallant forecastle. The captain, officers, and engineers are accommodated in deck houses on the bridge deck, the crew being berthed forward. Her machinery will be triple-expansion engines of the most modern type, with three large steel boilers, which have been constructed at her builders' engine works, and will be fitted within the next few weeks. We understand this steamer is now the property of the Hamburg-American Co., who have purchased her from Liverpool owners, who placed the order with Messrs. Workman, Clark & Co., Limited.

We have quite a large list of casualties to chronicle in connection with the following large steamers, all of which were built at Belfast. The s.s. *Germanic*, of the White Star Line, arrived here from New York on the 17th ult., after her unfortunate accident of getting submerged at New York, she having steamed across under her own steam. She will be put in dry dock in order to have her hull cleaned, and will then undergo a thorough overhaul both internally and externally, and it is expected she will again take up her station within a few weeks.

The s.s. *Torr Head* has also been in dry dock during the past month, having the damage to her plates rectified, which it will be remembered was caused by her coming in contact with an iceberg in the Western Ocean. The repairs have been successfully carried out by the builders, Messrs. Harland & Wolff, and she has again left this port.

On the 18th of March the s.s. *China*, belonging to the Peninsular and Oriental Steam Navigation Company, arrived in Belfast Harbour. This vessel, registering as she does 7,800 tons, is one of the finest of the P. & O. fleet, and it will doubtless be remembered that on the 25th March, 1898, she ran ashore whilst on her usual run from Sydney to London with passengers and freight. So tightly was she wedged in between rocks that it was believed that her Belfast double-bottom system and the sterling work of her builders alone saved her from breaking in two. Several rocks pierced her bottom in the forepart, and her fore-holds were full of water immediately after stranding; however, salvage operations were at once commenced, but it was only after five months' hard work that the repairs necessary to make her watertight were effected. Once this was done the salvage steamers pumped her out at the rate of 14,000 tons of water per hour, and on the 17th September last she was re-floated. At Perim she underwent some more repairs, and last month commenced her homeward voyage. The sides of the *China* show some of the hardships she has come through, but the injuries she has received will be better seen after she is put in dry dock. It is said that the salvage operations for the vessel alone cost £130,000. Her builders, Messrs. Harland & Wolff, will, of course, carry out the necessary repairs.

Besides these, the *Rotterdam* and *Staterdam*, both of which vessels were recently built at the Queen's Island, have been docked and fitted with a large addition to their water-ballast capacity, as well as having some minor improvements fitted. Both these vessels have again left this port, but somehow the *Staterdam* on her outward trip ran ashore on the Antrim side of Belfast Lough, and had to return to port again to be put in dock, but the damage done being trifling, she again left on the 18th ult., for Rotterdam to load cargo.

With all these extensive repairs on hand, Messrs. Harland & Wolff will be kept exceptionally busy for some weeks, and any casual observer may see how the want of good graving dock accommodation tends to hamper important repairs, as well as preventing the taking of Government contracts by this firm. Several of these have been offered them recently, but have had to be refused owing to the want of dry dock accommodation; however, we understand that a deputation from the Belfast Harbour Trustees have again been appointed to visit the Government Officials at Whitehall, to impress upon them, if possible, the necessity of rendering assistance with the graving dock accommodation financially and otherwise, and we trust they may be successful in their mission.

We referred last month to the most successful trial trip of the new Allan Liner *Castilian*, which was built and engined by Messrs. Workman, Clark & Co., Ltd., and it is accordingly with much regret we have to now report her short and most unfortunate career, as on her return maiden voyage she got on the rocks on the Nova Scotian coast, and has now broken up and sunk in deep water, but fortunately no lives were lost by the catastrophe.

The s.s. *Parisian*, also belonging to the Allan Line, is expected here very shortly to have her engines tripled and new boilers supplied by Messrs Workman, Clark & Co., Ltd. This was erroneously stated in last month's Clyde Notes as being executed by Messrs. R. Napier & Son, Glasgow.

So far no new orders are reported to have been booked here, but there is plenty of work in hand for many months to come, although the want of material for both shipbuilding and engineering works is causing great delay in the finishing of vessels.

It may be interesting to note here that shipbuilding is about to be re-commenced in Londonderry, the Foyle Shipyard being almost ready for building. There have been many changes effected on the plant and buildings since they were taken over y the Foyle Shipbuilding Company, and in a very short time e yard will be most complete in all the necessary arrange-nts. Four long building ways have been laid out with a to executing the extensive orders promised, and the blocks have been laid on second longest ways for an order on hand. This is a steamer of 6,800 tons deadweight, to be built of steel, and for which a quantity of plates have already arrived from Glasgow. The ways laid for the steamer are much longer than any laid when the yard was previously open. Formerly the vessels were built square to the yard, and launched straight out into the river, but the ways are now all being laid at an angle to go down the fair way, which will give much more extensive launching limits, and enable the vessels to be brought up more rapidly and also more convenient to the finishing wharf. A number of minor changes in the arrangement of the yard have also been made, all of which will tend to make the operations in the various departments more easily, more economically, and more expeditiously carried out, and it is expected that within a very short time a start will be made in forging the keel of the steamer on order.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—There is a growing activity in the shipbuilding and marine engineering trades of Barrow, because with every week and every month increased facilities are being provided by the extension of old premises, the building of new ones, and the utilisation of new and improved tools of every sort. The works of Vickers, Sons & Maxim, which were well equipped as the Naval Construction and Armament Co.'s works, are now much more perfect in every department, and changes are being effected on every hand whereby even greater excellence of facility will be brought into play. In addition to the ordinary up-to-date machinery produced by English and Scotch makers for shipbuilding and engineering purposes, several very clever and economic machines of American origin are being, and have already been, put down. These are doing good work, and are in very many respects really marvellous specimens of engineering skill. It speaks well for the future of Vickers' concern at Barrow that so much enterprise is being shown in this work of bringing the works up-to-date, and what is more, keeping them up-to-date, because the advantages which this policy will give will be such as will enable the firm to work profitably when less well-equipped establishments cannot pay. Some time ago it was intimated in the monthly report under this head that Vickers, Sons & Maxim had acquired a large slice of additional land by which they proposed to extend their shipbuilding department and their slip-ways. In fact, the increase of the yard will give more than double the present frontage to Walney Channel and the present launching area. A large steel-casting foundry is about to be built in the engineering department, and a new wing to the engineering shop about 1,000 ft. long by 60 ft. wide has been erected in which the work of making gun mountings will be carried on. Some very fine machinery is being put down in this department, and work has already been commenced. A very large number of orders are already in hand for the building of gun mountings for Vickers' guns, not only those required for ships building at Barrow, but for other ships and for other purposes. It is in fact very probable that this branch of engineering at the Naval Construction Works will be one of the most active. It would be difficult, however, to imagine a more active state of things than is evidenced at present in the engineering works proper, for there is not only under construction at present the engines and machinery of H.M.S. *Vengeance*, but for the first-class cruisers *Hogue*, *Euryalus*, and *King Alfred*, the name given to the improved *Powerful*, to be built at Barrow. Further than this there are the engines for the West African and Pacific boats, the engines for the Pacific Co.'s liner, and much minor work. The launch of H.M.S. *Vengeance* will probably not take place until July, but the work of both hull and engines has progressed very much and the delay in her launch will not in any sense mean any delay in the time of her completion. Ships can be launched at a very heavy weight in Barrow, not only because of the hardness of the ways on which they are built, but because of the great area and depth of water in which they are launched. Work has been commenced on two of the three first-class cruisers in course of construction, and the preliminaries for the *King Alfred* are being rapidly pushed forward. She will probably be put down on the ways from which the *Vengeance* will be launched unless another order is booked in the meantime, and then another permanent way will be made for a cruiser. Messrs. Vickers are among the firms tendering for the new first-class cruisers of high speed required to complete last year's supplementary programme. The *Amphitrite*, first-class cruiser, was delivered during last month to Chatham Dockyard, and made the voyage round the coast under easy steam very satisfactorily. She is being copper-sheathed in the dry dock, and sometime during April, will commence her speed and other trials. The first of the two West African steamers was launched at Barrow in March, and will soon be ready for sea. Her sister ship is almost ready for launching. Every effort is being made to finish the Pacific steamer *Ortona* so that she may be launched in about three months, as her owners require her to take an early position on the Pacific station. There is a big scheme on for the provision of an additional thousand houses at Barrow, chiefly for the accommodation of the workmen of Messrs. Vickers, Sons & Maxim. The scheme is not yet fully out, but it is noteworthy that the requisite land has been acquired on Walney Island near the shipyard, and that Walney is destined to become a very important adjunct to Barrow at an early date.

West Cumberland.—There is great activity in the shipbuilding industry in West Cumberland and the two yards at Maryport and Workington are fully employed, and likely to remain so for some time to come.

Shipbuilding Material.—The demand for shipbuilding materials is very steady and full, and orders are coming to hand more freely than makers can deal with them. At the Barrow Steel Works arrangements are in progress for increasing the output of plates and other materials, and there are some prospects of a steel angle mill of a modern economic type being put down. Plates are quoted at £7 2s. 6d., to £7 5s. per ton.

The Hematite Trade.—Much briskness is shown in the hematite pig-iron trade, although prices have shown many fluctuations during the past month. Makers are very steady at 60s. to 61s. for mixed Bessemer, Nos. net. f.o.b., and warrant sellers ask 59s., buyers halfpenny less net. cash. Stocks of warrant iron in hand have increased to 210,000 tons.

Shipping.—The shipping trade is fairly busy, but the returns of tonnage exports do not show up favourably compared with last year.

Reviews.

The Engineer's Year Book of Engineering Formulæ, Rules and Tables for 1899. By H. R. Kempe, A.M.Inst.C.E. London: Crosby Lockwood & Son, 1899.

Mr. Kempe, in bringing out the sixth issue of his useful publication, has afforded—in addition to the information which has been contained in his previous annuals—a large amount of new information. An interesting article for dredging has been contributed by Messrs. Flower & Everett. They give accounts of the methods of work and of the actual results attained thereby in various foreign rivers, such as the Weser, the Volga, and in certain Dutch rivers. For small works they seem to prefer the old-fashioned spoon-and-bag method to the more modern plan of operating a grab by a crane, as they contend that it gives a more level bottom instead of a number of deep holes and high ridges. In view of the increased dimensions of modern steamers and of the necessity thus laid upon harbour authorities to increase the depth of their channels, this article seems singularly opportune. Important contributions in railway matters are afforded by various writers, well qualified to speak with authority. In view of the recent disclosures as to the methods by which the late Mr. Keeley achieved the reputation of his motor, the exhaustive remarks of Mr. Unwin on the transmission of power by compressed air, will be read with unusual interest.

A Retrospect of Eight Decades. By the Rev. E. L. Berthon. London: George Bell & Sons, 1899.

To most of our readers the author of this very chatty volume is best known as the inventor of the collapsible boat which bears his name. He, however, lays claim to the parentage of far more important inventions, including no less a factor in our modern civilisation than the screw propeller. As long ago as the year 1835 he was experimenting with his *Archimedes*, a three-foot twin-screw model, on the Lake of Geneva. Having faith in this device as a propelling power, and a certain interest in naval circles, he was able to show his model at work to the Surveyor of the Navy, and from him obtained an opinion highly characteristic of the official—at all events, of that day—to the effect that "the screw was a pretty toy, which never would and never could propel a ship." Mr. Smith, who in 1838 brought the invention again to the notice of the Admiralty, arrived, as Mr. Berthon most candidly admits, at it by an entirely independent investigation; and no doubt the same could be said of the researches of M. Ericsson, the Swedish inventor, who transferred his genius to the American people. Another invention, which appears to have been entirely that of our author, was a speed indicator, which was fitted to at least two of the Royal yachts. Amongst a very large amount of discursive information, which tells us in an interesting fashion of the great changes which have taken place during her Majesty's reign, we get little glimpses of matters which will be of interest to many of our readers, such as a brief account of a trip in the old P. & O. liner *Ripon* to the Mediterranean, and a longer history of a Cape voyage in the Union liner *Spartan*. Travels in Italy and Ireland, visits to Osborne, with models of his inventions, coach rides in our own country in pre-railway times, and a good deal of pleasant chat about people met in those far-off days, make up a very entertaining volume of very light reading.

Reed's Marine Boilers, their Priming and General Management, and Notes on Water-tube Boilers. By Henry J. Davis. Second edition.

It is with no little pleasure that we take up this book for review. Mr. Reed has done so much, and has placed the marine engineers under his obligation to so large an extent with his book aids to examinations under the Board of Trade, that a fresh edition of a book on boilers is an acquisition. A book on boilers is now incomplete which leaves out of consideration the new forms of water-tube boilers. Two years ago there still remained doubts whether the water-tube boiler had come to stay. These doubts have now been completely allayed by the action of the Admiralty for the Navy, and Messrs. J. Wilson & Sons, of Hull, for the mercantile marine. The frontispiece of this book shows the trend of things in marine boiler work as well as anything else. Formerly a work on boilers would have one of the large triple-furnace multitubular boilers for frontispiece; this one has the newest form of Belleville boilers, that with the economiser on the top.

The book begins with a long paper by Mr. W. R. Grove on boiling water. In it he informs us that in proportion as water is deprived of air the character of its ebullition changes, and it becomes more like that of sulphuric acid. The author then goes on to explain circulation, but on this he only refers to that of the Scotch boiler, and does not treat of the valuable experiments made by Professor Watkinson on that of water-tube boilers. We think this a mistake. The whole economy of the water-tube boiler depends on its rapid circulation, and therefore a work which treats of water-tube boilers without going fully into the question of circulation is the play of Hamlet without the Prince of Denmark. There is an excellent table showing the estimated performances of boilers of various types compared with their steam capacity and water level area. A feature in the book is the frequent reference to original papers read at the several engineering societies. This is as it should be. It thereby ensures the book keeping abreast with current engineering thought. Feed heaters are dismissed with a page, and if we consider that they occupied so much of the attention of the Naval architects at their last session, we think that is much too little. We agree, however, with the views laid down with regard to the same. The best known types of water-tube boilers are well described, but some of the best known are entirely omitted. For example, we find Phillip's boiler but not Mr. Mumford's. Then the Durr is omitted, although thousands of horse-power have been fitted on the Continent. These are some of the errors of the book.

The book is of 223 pages and has an excellent index. The type is large and clear. Generally speaking it may be said to be a very good elementary work on boilers. It has been divided into sections. We would have preferred chapters. The figures are very good, though few of them are working drawings. We can heartily recommend it to our readers.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Boadicea.—On February 9th there was launched at Hull for the Hellyer's Steam Trawler's Co., Ltd., of Hull, an iron ketch-rigged steamer, named the *Boadicea*.

Gilderoy.—On February 10th there was launched at Bill Quay-on-Tyne, for Messrs. Ellis, Spencer & Co., Limited, of Grimsby, a steel schooner-rigged steamer of about 153 tons gross, named the *Gilderoy*.

St. Bede.—On February 11th there was launched at Sunderland for Messrs. Rankin, Gilmour & Co., of Liverpool, a steel schooner-rigged steamer of about 3,600 tons gross, named the *St. Bede*.

The Mary.—On February 11th Messrs. Hunt, Fowler & Co., Hull, launched from their yard a steel coasting steamer built to the order of Mr. W. Nettleton, of Hull. Her dimensions are:—Length, 81 ft. 6 in.; breadth, 17 ft. 9 in.; depth, 7 ft. 9 in. The engines, which are compound 25 N.H.P., will be supplied by Mr. W. M. Escreet, engineer, Burton Stather.

Assumburg.—On February 16th there was launched at Hull for the Steam Trawling Fishing Co., of Kennemerland, an iron steam ketch of about 168 tons gross, named the *Assumburg*.

Gwynwood.—On February 16th there was launched at Walker, for Messrs. Ross & Marshall, of Greenock, a steel schooner-rigged steamer, named the *Gwynwood*.

Fulmar.—On February 23rd there was launched at Hull, for Messrs. Pickering & Haldanes Steam Trawling Co., Limited, of Hull, an iron steam ketch of about 211 tons gross, named the *Fulmar*.

Akranes.—On February 24th there was launched at North Shields an iron steam ketch of about 190 tons gross, named the *Akranes*.

Sirdar.—On February 24th there was launched at North Shields for Messrs. G. Meadows, Limited, of Grimsby, an iron and steel steam ketch of about 190 tons gross, named the *Sirdar*.

Sokoto.—On February 25th Messrs. Vickers, Sons & Maxim launched from their Naval Construction Works at Barrow the first of two sister steamers building by them to the order of the British and African Steamship Co. She is a first-class passenger and cargo steamer of about 4,000 tons, built to the highest class of Lloyd's, and fitted with all the latest improvements for the African trade. She is 345 ft. long between perpendiculars, 42 ft. beam, and 25 ft. 8 in. depth moulded. Her engines are of the triple-expansion type, with cylinders of 23 in., 38 in., and 63 in. respectively, and her steam pressure is 180 lbs. The new vessel, which is named *Sokoto*, was launched by Mrs. Ella M. Dempster, daughter-in-law of Mr. John Dempster, one of the directors of the British and African Co.

King Harold.—On February 27th there was launched at Selby, by Messrs. Cochrane & Cooper, a steamship built to the order of the Viking Steam Fishing Co., of Grimsby. The vessel was named *King Harold*.

Nelson.—On February 27th there was launched by Messrs. John Jones & Sons, at Liverpool, the powerful steam tug *Nelson*, of about 150 tons gross, indicating 600 H.P., built of Siemens-Martin steel, to the highest class at Lloyd's, and will form a valuable addition to the fleet of the Alexandra Towing Co., who have ordered a duplicate vessel from the builders.

Raithmoor.—On February 27th there was launched by Messrs. John Readhead & Sons, at South Shields, the *Raithmoor*, of the following dimensions:—Length, 335 ft. overall; breadth, 47 ft.; depth, moulded, 25 ft. The vessel is of the single-deck type, with full poop aft containing cabins, and long bridge amidships, with accommodation at after-end for engineers, and topgallant forecastle for crew. The ship has been built under special survey, and classed A1 at Lloyd's. She will carry 5,130 tons deadweight on a light draught, and is fitted with all the latest improvements and appliances for the working of the vessel, and for rapid loading and discharging of cargo. The engines are of the triple-expansion type, and are constructed by Messrs. Readhead & Sons. The cylinders are 24 in., 40 in., and 64 in. by 42 in. stroke, steam being supplied by two large steel boilers, working at a pressure of 160 lbs. per square inch. The vessel has been built to the order of Messrs. Walter Runciman & Co., of Newcastle-on-Tyne and London.

Wandby.—On February 27th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 336 ft. 6 in.; breadth, extreme, 46 ft. 6 in.; depth, moulded, 27 ft. 3 in. The steamer has been built to the order of Messrs. R. Ropner & Co., West Hartlepool, and is of the three-decked rule, fitted with the builders' patent trunk, full poop, bridge, and topgallant forecastle. The saloon and cabins for captain and officers will be fitted up in the poop, the accommodation for engineers in iron houses on the bridge deck, and for the crew in the forecastle as usual. She has double bottom on the cellular principle for water ballast, and will carry about 6,000 tons on Lloyd's summer freeboard, on a light draught of water. She will have all the most recent appliances for the expeditious and economical loading and unloading of cargoes, has direct steam windlass, steam steering gear amidships, with powerful screw gear aft, six large steam winches, to which steam is supplied by two large vertical donkey boilers, stockless anchors, &c., &c. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, having cylinders 24 in., 40 in., 66 in. by 45 in. stroke. The christening ceremony was gracefully performed by Miss Margie Ropner, of West Hartlepool, daughter of one of the managing owners, who gave her the name of *Wandby*.

Mabel Grace.—On February 28th Messrs. Laird Brothers launched at Birkenhead a steel paddle-wheel steamer, which they have built to the order of the South-Eastern and Chatham and Dover Railway Companies for their passenger traffic between Folkestone and Boulogne. The vessel has been specially designed to meet the requirements of the Channel passenger service. She has a turtle back neck forward, and a large deck-house aft, over which there is a spacious promenade deck in continuation of the bridge. She is 300 ft. long, 36 ft. beam, and measures 1,920 tons o.m. Her machinery will consist of a set of three-cylinder compound fixed diagonal engines of large power to ensure a high speed. The vessel was named *Mabel Grace*. The companies were represented by Mr. G. Kelson, consulting naval architect, and Mr. Neil Guy, superintending engineer.

Airedale.—On February 28th Messrs. Wm. Gray & Co., Limited, launched the fine steel screw steamer *Airedale*, which they have built to the order of the London and Northern Steamship Co., Limited, Messrs. Pyman Bros., London, managers. She will take Lloyd's highest class, and her dimensions are, viz.:—Length overall, 341 ft.; breadth, 47 ft.; and depth, 24 ft. 10 in. The deck erections consist of a poop, bridge and forecastle. A handsome saloon and cabins for officers, &c., are fitted up aft; the engineers' rooms are in the bridge, and the crew's accommodation forward, including a bath-room for seamen and firemen. The hull is built on the deep-frame system, with a cellular double-bottom, large hatchways, five steam winches, steam steering-gear amidships, hand-screw gear aft, two donkey boilers, patent direct steam windlass, boats on beams overhead, shifting boards throughout, stockless anchors, two telescoping masts with fore and aft rig, and a complete outfit for a first-class cargo vessel. The Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, supply the engines, which are of the triple-expansion type, having cylinders 24 in., 38 in., and 64 in. diameter, with a 42 in. piston stroke, and two large steel boilers to work at 170 lbs. pressure per square inch. The vessel has been built under the superintendence of Mr. Wm. Birchby, on behalf of the owners, and the ceremony of christening the steamer *Airedale* was gracefully performed by Miss Nellie Pyman, of West House, West Hartlepool.

Fred.—On February 28th there was launched from the yard of Messrs. R. Williamson & Son, Workington, a finely-modelled screw steamer, built to the highest class at Lloyd's, for Mr. T. G. Best, Liverpool. Her dimensions are:—Length, 140 ft.; breadth, 23 ft.; depth, moulded, 10 ft. 3½ in., and designed to carry 330 tons on Lloyd's freeboard. The engines are to be supplied by Messrs. Ross & Duncan, of Govan, and are of the compound type, having two cylinders 18 in. and 36 in., with a stroke of 24 in. As she left the ways she was gracefully named the *Fred* by Miss Best.

Rajah.—On February 28th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions:—100 ft. by 21 ft. by 11 ft. depth of hold, built to the order of Mr. Ernest Sleight, Grimsby. Engines of 45 N.P. are being supplied by

Messrs. C. D. Holmes & Co., Hull. The vessel will be completed ready for sea with all modern appliances for trawling. Mrs. G. F. Carter, of Grimsby, named the vessel s.s. *Rajah*, and after the ceremony the company adjourned to the Beverley Arms for breakfast.

Twin-Screw Steamer.—On February 28th Sir Raylton Dixon & Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, a handsomely-modelled twin-screw mail and passenger steamer, built for Messrs. Elder, Dempster & Co., of Liverpool. Her principal dimensions are:—382 ft. by 46 ft. by 25 ft., moulded. Accommodation will be provided for 108 first-class and 50 second-class passengers in most spacious and handsomely fitted cabins, with large dining-room panelled in marble and inlaid wood in house on deck. The first-class smoking-room, second-class smoking-room and cabin entrances will be elaborately fitted and decorated, and the vessel will be lighted throughout with electric light. A powerful refrigerating machine with large cooling chambers will also be provided for the conveyance of fresh meat, provisions, &c. Twin-screw triple-expansion engines will be fitted by Messrs. The Wallsend Slipway and Engineering Co., Limited, Newcastle-on-Tyne, having cylinders 21½ in., 35 in., 59 in. by 42 in. stroke, supplied with steam by four large single-ended boilers working at 180 lbs. pressure, and fitted with Howden's system of forced draught.

Oceanic.—On March 1st Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions:—120 ft. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold. This is the largest trawler yet built, and is an addition to the fleet of Messrs. Hall, Leyman & Co., Limited, Hull. Triple-expansion engines, 70 N.P., are being supplied by Messrs. C. D. Holmes & Co, and the vessel will be completed ready for sea with the most modern appliances for trawling. Miss M. E. Wiley, of Brough, named the vessel the *Oceanic*, and after the ceremony the company adjourned to the offices of the builders for luncheon.

Onward.—On March 1st there was launched at Whitby, to the order of Messrs Joseph Constant, of London, a steam barge, named the *Onward*. Her dimensions are as follows:—Length, 130 ft.; breadth, 25 ft.; depth, moulded, 10 ft. 11 in. She will be engined by Messrs. Fay & Co., Southampton.

Rhodesia.—On March 1st Messrs. John Priestman & Co. launched at Southwick, Sunderland, a steel screw steamer 351 ft. in length, 48 ft. in breadth, and 27 ft. 4 in. depth, which has been built to the order of Messrs. John Cory & Sons, Cardiff, and will take Lloyd's highest class three-deck rule. The engines have been built by the North-Eastern Marine Engineering Co., Sunderland, and are of the triple-expansion type, with cylinders 25 in., 41 in., and 67 in., by 45 in. stroke. Two large boilers supply steam at a pressure of 160 lbs. per square inch. The vessel, during construction, has been under the supervision of Captain Couch, and was christened *Rhodesia*.

Newington.—On March 2nd there was launched at Hull by Messrs. Cook, Welton & Gemmel, a new steam trawler named the *Newington*. The vessel will be fitted with engines by Messrs C. D. Holmes & Co.

Seine.—On March 4th Messrs. William Dobson & Co. launched at Low Walker on Tyne the steel screw steamer *Seine*, which they have built to the order of the United Steamship Company, of Copenhagen. The dimensions are:—Length, 247 ft.; breadth, 34 ft.; and depth, moulded, 18 ft. 6 in. The vessel is built to the highest class of the Bureau Veritas. The engines, which are being constructed by the North-Eastern Marine Engineering Co., Limited, are of the triple-expansion type, having cylinders of 19½ in., 32½ in., and 54 in. diameter, by 36 in. stroke. Steam is supplied by two single-ended boilers working at 180 lbs. pressure.

Beaver.—On March 9th there was launched from the yard of Mr. Joseph Scarr, Grovehill, Beverley, a steel screw tug of the following dimensions:—Length overall, 80 ft.; beam, moulded, 17 ft. 6 in.; depth, moulded, 9 ft. The tug was built to the order of Joseph Constant, Esq., of London, and is to take Lloyd's highest class for tug purposes. She is built of steel throughout, and specially designed for deep sea towing, with shelter deck full length of boiler casing. On leaving the ways she was christened the *Beaver* by Miss Palmer.

Clinton.—On Friday afternoon, March 10th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length overall, 350 ft.; breadth, extreme, 46 ft.; depth, moulded, 27 ft. 3 in. This vessel, which has been built to the order of Messrs. H. Samman & Co., of Hull, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is of the three-deck type with one laid deck, with poop, bridge, and topgallant forecastle. Accommodation for captain and officers is provided in a large deck-house on bridge, engineers being berthed in bridge 'tween decks at after end, and crew in topgallant forecastle. A cellular double bottom and fore-and-aft peak tanks are fitted for water ballast. Equipment includes six steam winches, large vertical donkey boiler, steam windlass, stockless anchors, steam steering gear, &c., &c. The engines, by Messrs. Blair & Co., have cylinders 24½ in., 40½ in., and 66½ in. by 42 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 160 lbs. As the vessel left the ways she was christened *Clinton* by Miss Elsie Sage, daughter of W. A. Sage, Esq., of Hull, engineer superintendent for the owners.

Clan Colquhoun.—On March 11th Messrs. W. Doxford & Sons, Limited, of Sunderland, launched the turret-deck steamer *Clan Colquhoun*, the ninth vessel of this type built for the Clan Line Steamers, Limited, of Glasgow (Cayzer, Irvine & Co.), and the 49th steamer afloat. Dimensions:—440 ft. by 51 ft. 6 in. by 32 ft.; deadweight capacity, 8,400 tons. The engines have cylinders 27½ in., 45½ in. and 75 in. by 60 in., also built by the firm. The vessel is built under British Corporation survey, highest class, and on leaving the ways was gracefully christened by Miss Portlock.

Kent.—On March 11th there was launched by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, at Hebburn-on-Tyne, the large steel screw steamer *Kent*. This is the first of four sister vessels building to the order of Messrs. Wm. Milburn & Co., of London. Her principal dimensions are:—Length over all, 435 ft.; breadth, 54 ft.; depth, 40 ft. to shelter deck. The vessel has been built in excess of the highest class at Lloyd's, and is the 14th of a series of 18 vessels built and building for the Australian and New Zealand frozen meat trade. The engines have been built by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, and are of the triple-expansion surface-condensing type, with cylinders of 30 in., 48 in. and 78 in. diameter, and 54 in. stroke.

Peareth.—On March 11th Messrs. Irvine's Shipuilding and Dry Docks Co., Limited, launched a handsomely-modelled steel screw steamer of 4,820 tons deadweight carrying capacity on Lloyd's summer freeboard. The vessel has been built to the order of Messrs. Beckingham & Co., Newcastle-on-Tyne, and is built to Lloyd's highest class under special survey. She is of the following dimensions:—332 ft. overall by 46 ft. extreme breadth by 23 ft. ½ in., having poop, long bridge and topgallant forecastle for the housing of the crew, cellular double bottom for water ballast, all fore and aft. The accommodation for captain, officers and engineers is provided for in houses on bridge deck, the former immediately under the navigating bridge and the latter alongside the engine casing, and cabins arranged in the latest fashion to conduce to the comfort of the officers. Special regard has been paid for dealing with rapid loading and discharge of cargoes, for which extra large hatchways have been fitted, with powerful winches of the company's own make, and double derricks to hatches, together with all the latest improvements in the entire outfit of the vessel, including steam steering gear and the latest improved steam windlass, &c. The boats will be placed on platform deck overhead. The engines are of the triple-expansion type, and will be supplied by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, Middlesbrough, and are of the following dimensions: 24 in., 38 in., and 64 in. by 42 in., steam being supplied by two large single-ended boilers working at 160 lbs. As the vessel left the ways the christening ceremony was gracefully performed by Mrs. Beckingham, of Newcastle. In passing we may state that the method adopted was rather novel, a little air gun being used, the projectile being a bottle of wine, which by a very simple arrangement was shot by the lady from the platform against the vessel's bows. The hull and machinery have been built under the supervision of Mr. James Anthony, the owners' superintendent.

Jabiru.—On March 11th Messrs. Wigham Richardson & Co. launched from their Neptune Shipyard the s.s. *Jabiru*, which they are building for the Continental service of the Cork Steamship Co., of Cork. The steamer is 255 ft. in length by 33½ ft. beam, and she has very comfortable accommodation for a limited number of passengers. She will be fitted with triple-expansion engines designed to drive her at good speed, and the arrangements for working both the ship and cargo are of the most improved type. This steamer is the fourth vessel built by Messrs. Wigham Richardson & Co. for this company, and the builders have more work in hand for them. The owners were represented at the launch by Capt. Hore, of Liverpool, the marine superintendent, and by Mr. J. A. Flockhart, of Liverpool, their superintendent engineer. The christening ceremony was gracefully performed by Miss Liljquist, of Helsingfors.

Elantsobe.—On Tuesday, March 14th, Messrs. Wm. Gray & Co., Limited, launched the fine steel screw steamer *Elantsobe*. She is of the following dimensions, viz.:—Length overall, 300 ft.; breadth, 42 ft.; depth, 20 ft. 2½ in., and has been built to the order of Raman-de-la-Sota, of Bilbao. She will take Lloyd's highest class, and is of the partial awning-deck type, with the saloon and accommodation for captain and officers in the poop, the engineers' berths amidships, and the crew's quarters forward. The vessel is built on the web-frame system with cellular double bottom for water ballast, and after-peak ballast tanks, steam winches, donkey-boiler, steam steering gear amidships, screw gear aft, steam windlass, schooner rig with patent folding masts, boats on beams overhead, and generally equipped in a first-rate manner for a cargo steamer. The engines are of the triple-expansion type, working on three cranks, made by the Central Marine Engine Works of William Gray & Co., Limited. The cylinders are 23 in., 36½ in., and 62 in. diameter, and the piston stroke of 39 in., with two large steel boilers to work at a pressure of 160 lbs. per square inch. The vessel has been built under the superintendence of Captain Ricardo-de-Goicoechea, on behalf of the owners, and the ceremony of naming her *Elantsobe* was gracefully performed by Miss Ethel Harris, of Torquay.

Claudius.—On March 15th Messrs. William Gray & Co., Limited, launched the large side-ballast tank steamer *Claudius*, which they have built to the order of Mr. C. Andersen, of Hamburg. Considerable attention is now being given to the ballasting of steamers, as the exigencies of the modern shipping trade require that ships should often go long distances in stormy seas, with simple bunker coal and ballast on board. The *Claudius* is somewhat similar to the *Mancunia*, the first side-tanker which was sent out by the same builders. The performances of the *Mancunia* have been very satisfactory. She made her first voyage in water ballast, and the captain reported that for ten days after leaving the channel, in strong gales and a very heavy sea, she behaved splendidly. Racing of the machinery was reduced to a minimum, it was never necessary to stand by the throttle-valve, and there was an absence of "hammering by the sea" in the fore end of the vessel, which is usual in such circumstances. The greatest angle of rolling in a heavy beam sea was 26 degrees, or practically half of what has been experienced in other vessels. Later reports from the same vessel confirm the great utility of the side ballast tank system. The *Claudius* is built to Lloyd's highest class, her dimensions are:—Length overall, 350 ft.; breadth, 51 ft.; depth, 27 ft.; deadweight capacity, 6,200 tons. There is considerable area on deck for carrying cattle or timber, &c., and the arrangements throughout the ship, including a special outfit of steam winches, derricks, &c., will enable cargo to be dealt with most expeditiously. The cellular double bottom extends throughout the ship, and with the after peak tank will contain 1,000 tons of water ballast, while the side tanks will hold 700 tons more, a total of 1,700 tons. The side tanks extend through the main and after holds and engine-room for a length of 191 ft., in way of which the ship has double sides, adding greatly to her strength and safety also. These advantages are secured without extra material being required in the construction of the side tanks. Lower decks and other parts used in strengthening ordinary ships and which greatly impede stowage being dispensed with, and the material applied in building the side tanks. Hence the new type loses nothing as a cargo carrier. The machinery consists of a fine set of triple-expansion engines of over 1,400 H.P., with three main boilers to work at a pressure of 170 lbs. per square inch, all from the Central Marine Engine Works of the builders. Mr. P. H. Bahnsen has superintended the building of the ship on behalf of the owners, and the patent side tanks are the invention of Mr. Archibald McGlashan, chief draughtsman to the builders. The ceremony of christening the *Claudius* was gracefully performed by Miss Brydon, of Hartlepool, daughter of the general secretary of Wm. Gray & Co., Limited.

Newholm.—On March 15th there was launched from the west *shipbuilding yard of* Messrs. C. S. Swan & Hunter, Limited, Wallsend, the second of two steel screw cargo steamers, built to the order of Messrs. J. J. & C. M. Forster, of Newcastle. The principal dimensions of the vessel are:—Length overall, 341 ft.; beam, extreme, 48 ft.; and depth, moulded, 26 ft. 6 in.; and she has been built to take the highest class at Lloyd's three-deck rule with one deck laid. The accommodation for the crew is provided in a large topgallant forecastle, the saloon and captain's room being in the poop, and the officers and engineers being berthed in houses on the top of the bridge. The deadweight carrying capacity of the vessel will be about 5,500 tons on a moderate draught of water. Facilities for working this large cargo have been amply provided. Besides the usual derricks on the masts, derricks have been fitted on four derrick posts, and an ample number of winches provided. In order to ensure safety in crossing the Atlantic in winter in ballast trim, a large deep tank has been provided for water ballast, besides the water ballast in the double bottom. The engines have been built by the North Eastern Marine Engine Co., Limited, of Wallsend, and are of the triple-expansion type, having cylinders 24 in., 40 in., and 64 in. diameter by 42 in. stroke, steam being supplied by three single-ended boilers 12 ft. 9 in. diameter by 10 ft. 6 in. long, working at a pressure of 170 lbs. per square inch. On leaving the ways the steamer was gracefully named the *Newholm* by Mrs. C. M. Forster. During construction the two vessels have been under the inspection of Captain Sarah, the marine superintendent of the owners.

LAUNCHES—SCOTCH.

Elgin, Eider and Era.—On February 24th there was launched by Messrs. Mackie & Thomson, Govan, three steam trawlers of 170 tons gross each, built to the order of Messrs. Muir & Houston, for the Great Northern Steamship Fishing Co., Limited, Hull. The vessels are 103 ft. 9 in. long between perpendiculars; 21 ft. in extreme breadth; and 11 ft. 7 in. in depth (moulded). Messrs. Muir & Houston will supply triple-expansion engines for each. The *Elgin* was launched by Mrs. Cassells, Partick; the *Eider*, by Mrs. Drummond, Glasgow; and the *Era* by Miss Taggart, Glasgow.

Gorbea.—On February 24th there was successfully launched from the yard of the Campbeltown Shipbuilding Co., a steel screw steamer of 3,400 tons deadweight for a Spanish firm of shipowners. The vessel, which has been built to the highest class at Lloyd's, is intended for general trading, She will be engined by Messrs. Hutson & Son, Glasgow. On leaving the ways the steamer was named *Gorbea* by Miss Jean Martin, Marieville.

Gymeric.—Lately Messrs. Russell & Co. launched at Port Glasgow a steel screw steamer named *Gymeric*, of 6,400 tons deadweight carrying capacity, built to the order of Messrs. Andrew Weir & Co., Glasgow. Her dimensions are;—Length, 345 ft.; breadth, 49 ft. 9 in.; depth, 28 ft. 6 in.; gross tonnage, 4,000 tons, She will be supplied with triple-expansion engines by Messrs. Rankin & Blackmore.

Clan Macaulay.—On February 27th Messrs. Alex. Stephen & Sons launched at Linthouse the fifteenth steamer built by them for the Clan Line. The vessel's dimensions are 326 ft. by 40 ft. 3 in. by 26 ft. 2 in., and her displacement is about 6,150 tons. She is classed 100 A1 three-deck rule in Lloyd's, under special survey. The fittings and equipments are very complete, and are all of the most modern and approved description. The main engines have cylinders 23 in., 38 in., and 63 in. diameter respectively, by 42 in. stroke. The boilers are fitted with Howden's forced draught, and work at 200 lbs. pressure. The steamer was named *Clan Macaulay* by Mrs. Joss, wife of one of the partners of Messrs. Cayzer, Irvine & Co., the managers of the Clan Line. Messrs. Stephen have other two steamers in hand for the Clan Line.

Belvoir Castle.—On February 27th Messrs. Gourlay Brothers & Co. launched at Dundee a steam trawler which they have built for the Crampin Steam Fishing Co., Grimsby, and which was named the *Belvoir Castle*. The trawler has been built to the highest class in Lloyd's Registry and specially designed for the Iceland line fishing trade. Her principal dimensions are:—Length, 123 ft. beam, 21 ft 9 in.; depth, 12 ft.; with a gross tonnage of about 200. The engines will be of the triple-expansion type,

Aurora and Aries.—On February 28th Messrs. Ramage & Ferguson, Limited, launched two steam trawlers, which form the first vessels built for the new company, "Newhaven

Trawlers, Limited." The dimensions are 105 ft. by 20 ft. 6 in. by 11 ft. 10 in. depth, moulded, and the propelling power is supplied by triple-expansion engines, having cylinders 12 in. 19 in., and 30 in. diameter, by 21 in. stroke, steam being supplied from a large multitubular boiler working up to 180 lbs. pressure. The christening ceremonies were gracefully performed, the first trawler being named *Aurora* by Miss Graham Brown, and the second was named *Aries* by Miss McKenzie Johnston, Edinburgh. The above trawlers have been built under the superintendence of Messrs. Irwin, Atkinson, and Young, consulting engineers, Liverpool.

Birker Force.—On February 28th there was launched from the Irvine Shipbuilding and Engineering Co.'s yard at Irvine a cargo steamer, built to the order of Mr. W. S. Kennaugh, Liverpool. Her dimensions are:—165 ft. by 25 ft. by 12 ft. Engines are to be fitted by Messrs. Hutson & Sons, Glasgow, and consist of a set of compound surface-condensing engines, having cylinders 18 in. and 40 in. by 30 in. stroke, steam being supplied from a steel boiler 13 ft. 6 in. in diameter by 10 ft. 6 in long, working at a pressure of 150 lbs. The vessel is rigged as a three-masted schooner, and is well supplied with deck gear for the speedy handling of cargo As the vessel left the ways she was named *Birker Force* by Mrs. Roger, Weir Lodge, Ayr.

City of Carlisle.—On February 28th the first vessel turned out by the new shipbuilding firm of Messrs. Taylor & Mitchell, Garvel Park Slip and Dockyard, Greenock, was launched, and was named the *City of Carlisle*. She is a screw steamer of the following dimensions:—120 ft. length, 21 ft. 6 in. breadth, and 11 ft. 6 in. depth, moulded, built to the order of Mr. G. W. Bowman, of Hull. She is specially adapted for deep-sea fishing, particularly at Iceland and Greenland. She will be supplied with triple-expansion engines by Messrs. Shanks, Anderson & Co., Pollokshaws. A large company of guests assisted at the ceremony, and Mr. Peter Taylor, in responding to the toast of his firm, said they were doing their best to make a name for Garvel Park. They had a graving dock alongside which was perhaps one of the finest in the United Kingdom. He thought they were entitled, having received every consideration from the Greenock Harbour Trust, to do the best they could in the way of getting work and recouping the Harbour Trust to some extent for the consideration they had shown.

May.—Lately Messrs. Hawthorns & Co., Limited, launched the twin-screw tender *May*, built to the order of the Northern Lighthouse Board. This vessel has been built for the special purpose of supplying the gas-lit buoys on the coast, and to act as an auxiliary to the present fleet. She is fitted with all the most modern appliances, including electric light, steam steering gear, &c. As she left the ways she was christened by Mrs. Johnson.

Fantee.—On February 28th there was launched at Whiteinch by Messrs. Barclay, Curle & Co., Limited, a steel screw-steamship, built to the order of the African Steamship Co., for their Liverpool and West African trade. The vessel is classed at Lloyd's 100 A1 spar-deck rule. Her dimensions are—345 ft. by 44 ft. by 25 ft. 8 in., and measures about 3,800 tons gross. She has been specially designed for the West African trade, her carrying capacity being large on a small draught to enable her to touch at ports not accessible to other traders On deck she is fitted throughout with all the most recent and up-to-date appliances for safe and rapid loading and discharging of cargoes peculiar to the West-coast trade. The vessel is being fitted out for 70 first-class and 40 second-class passengers, her 'tween decks being designed for the carrying of troops. She is a sister ship and duplicate of the *Sobo* (s.), of which a full description was given in our launch columns, November issue, page 331. The vessel and machinery have been supervised during construction by Mr. H. J. Ward, the company's naval architect, and Mr. W. G. B. Alder, the marine engineer superintendent. The machinery, of triple-expansion type, and the boilers, are being constructed by the builders at their Finnieston works. On leaving the ways the vessel was named the *Fantee* by Mrs. Goudie, wife of Captain Goudie, the commander. The vessel was afterwards towed to the harbour to receive her machinery.

Anaxo.—On March 3rd there was launched at Port-Glasgow, by Messrs. Russell & Co., a steel spar-deck screw steamer of 4,900 tons deadweight carrying capacity, for Messrs. G. T. Soley & Co, Liverpool. Dimensions:—Length, 325 ft.; breadth, 45 ft. 6 in.; depth, 25 ft. 6 in. Messrs. Kincaid & Co., Greenock, will supply the machinery. The ceremony of naming the steamer *Anaxo* was performed by Miss Alice Lambie, Lilybank, Port-Glasgow.

Hermes.—On March 4th there was launched from the yard of the Ailsa Shipbuilding Co., Troon, a finely-modelled steel screw steamer, built to the highest class at Lloyd's for the Neptun, Dampfschifffahrts Gesellschaft, Bremen, Germany. The engines, which are triple-expansion, are being fitted by Messrs. Muir & Houston, Limited, of Glasgow. The vessel is designed to carry about 1,760 tons deadweight on Lloyd's draught, and is fitted with four powerful steam winches, windlass, and steam and hand-steering gears, and every modern convenience for the rapid loading and discharging of cargo, and for the safe navigation of the vessel. As the steamer left the ways she was gracefully named *Hermes* by Miss Margaret Wallace, Ashgrove, Ayr.

Clan Mackay.—On March 13th there was launched at St. Monans a fishing-boat, built by Mr. John Robertson, to the order of the brothers Robert, Thomas, and James Mackay, sons of Mr. Robert Mackay, Dunn, St. Monans. The new boat is 69 ft. in length, with a breadth of beam 22 ft., and was named the *Clan Mackay*.

Warfield.—On March 13th Messrs. William Hamilton & Co. launched from their Glen Yard, Port-Glasgow, a steel screw steamer of about 2,100 tons net register, and to carry 5,400 tons deadweight, for Messrs. Hickie, Borman & Co., London. The vessel has been built for the Eastern and general trade. The following are the principal dimensions:—Length, between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in. The vessel has been built to the highest class at Lloyd's on the deep-frame system, and is fitted throughout with a double cellular bottom for water ballast, the after peak also being utilised for this. The accommodation for the officers and crew is of the most complete description, the saloon, captain's room, and two spare state rooms being in large deck house on bridge deck. The officers' and engineers' rooms are placed alongside engine casing on bridge deck, while the crew are berthed under the topgallant forecastle. The machinery, which is being supplied by Messrs. David Rowan & Son, Glasgow, is on the triple-expansion principle, the cylinders being 24 in., 40 in. and 65 in. diameter by 42 in. stroke, steam being supplied by two large boilers working at 180 lbs. pressure. As the vessel left the ways she was gracefully named the *Warfield* by Mrs. Hamilton, of Benclutha, Port-Glasgow.

Asahi.—On March 13th there was launched the Japanese battleship *Asahi* by the Clydebank Engineering & Shipbuilding Co., Glasgow, which they have built for the Japanese Government. The principal dimensions of the vessel, which weighed, as she stood on the blocks, about 7,500 tons, are:—Length, between perpendiculars, 400 ft.; length, overall, 425 ft. 6 in.; breadth, extreme, 75 ft. 2½ in.; depth, moulded, 43 ft. 7½ in.; normal mean draught of water, 27 ft. 3 in.; displacement, 15,200 tons. The armament will be entirely of Elswick design and manufacture. The ship is to be propelled by two sets of three-cylinder triple-expansion engines. Each of the sets is designed to develope 7,500 I.H.P., giving a combined I.H.P. of 15,000. Steam will be supplied by water-tube boilers of the Belleville economiser type, working at a pressure of 300 lbs., which will be reduced at the engines to 250 lbs. The coal bunkers will have a total capacity of about 1,400 tons. The launching and naming ceremony was performed by Mme. Kato, wife of the Japanese Minister.

Newport News.—On March 13th there was launched at Port-Glasgow, by Messrs. A. Rodger & Co., a steel screw steamer of the following dimensions:—Length, 314 ft.; breadth, 44 ft.; depth, 23 ft. 3 in.; gross tonnage, 2,560 tons, with a deadweight carrying capacity of 4,350 tons. Messrs. Hall-Brown, Buttery & Co. Glasgow, will supply the engines, the cylinders of which are 22½ in., 37 in., and 61 in., by 42½ in. stroke. The vessel was named *Newport News* and is built to the order of Messrs. Furness, Withy & Co., West Hartlepool.

Paragon.—On March 14th there was launched at Aberdeen by Messrs. Alexander Hall & Co., a steam trawler, built to the order of Messrs. Laverack & Stephenson, Hull. The vessel is 115 ft. in length, 21 ft. in breadth, and 11 ft. 6 in. in depth of hold. She will be fitted with triple-expansion engines, and was named the *Paragon*.

Valetta.—On March 15th there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel screw steamer for Messrs. Gow, Harrison & Co., Glasgow. The dimensions are: — Length, 320 ft.; breadth, 46 ft.; depth, moulded, 23 ft. 9 in. The vessel is built to Lloyd's highest class and is designed to carry about 4,700 tons on a comparatively light draught. The erections are, a poop, long bridge and topgallant forecastle, the crew being berthed in the latter, whilst the saloon, officers' and engineers' rooms, etc., are placed in houses in top of bridge deck. Six steam winches, and eight derricks form the discharging gear, for four large hatches. The vessel is also fitted with a powerful steam windlass, and steam steering gear, the latter being placed near the engine-room with controlling shafting to bridge. The machinery consists of triple-expansion engines having cylinders 22½ in., 36½ in., and 60 in., by 42 in. stroke, with steam at 180 lbs. pressure, supplied from one large boiler fitted with Howden's forced draught. The ceremony of naming the ship *Valetta* was gracefully performed by Miss Clark, Montgomerie Crescent, Kelvinside. After the launch the vessel was taken to Glasgow, where Messrs. Hall-Brown, Buttery & Co. will supply the machinery. The ship and machinery have been superintended during construction by Mr. Geo. Macfarlane, M.I.N.A., Glasgow.

Maidstone.—On March 15th there was launched by Messrs. William Denny & Bros. from their yard at Dumbarton, a steel screw steamer, built by them for the South-Eastern and Chatham and Dover Railway Co.'s service between Dover and Calais. The moulded dimensions are:—195 ft. by 28 ft. by 15 ft. She has been specially designed for this service, the builders being assisted in the arrangement of details by Captain Dixon and Mr. Messenger, the company's superintendents at Dover. She has a straight stem and elliptical stern. The bottom throughout, except under machinery, is on the cellular principle, and the peaks are also adapted for carrying water for trimming purposes. She has two pole masts. The officers are berthed on the lower deck aft, and the crew in side-houses inside the forecastle. Horse stalls are fitted in the bridge and in the after-hold. She is lighted throughout, holds included, with electric light. The engines are of the three-cylinder triple-expansion type, and, with the two boilers, have been supplied by Denny & Co. The christening ceremony of naming the vessel *Maidstone* was performed by Miss Eva Ward, daughter of Mr. John Ward, one of the partners of the firm of Messrs. William Denny & Bros.

Scandinavia.—On March 16th there was launched by Messrs. Carmichael, Maclean & Co., at Greenock, a handsomely-modelled steel screw steamer, to the order of Messrs. Svneska Lloyds. The vessel has been designed to carry a deadweight of about 1,800 tons, and has accommodation under poop for crew and on bridge for passengers, captain, and officers, and will be furnished with all modern appliances for the quick working of cargo. The vessel has been built with a view of adaptability for general trade, and also for carrying a deck cargo of wood when required. The dimensions of the vessel are:—239 ft. 4 in. by 35 ft. by 17 ft. 9 in. moulded to main deck; gross tonnage, about 1,250 tons. She has been constructed to the highest class at Lloyd's and the requirements of the Swedish law. The engines will be supplied by Messrs. Muir & Houston, Limited, of Glasgow. The ceremony of naming the vessel the *Scandinavia* was performed by Miss Ruth Maclean, Dowanhill, Glasgow.

Poulton.—On March 17th Messrs. Fleming & Ferguson, Limited, Paisley, launched from their yard the powerful twin-screw pump hopper dredger *Poulton*, built to the joint order of the Lancashire & Yorkshire & London & North-Western Railway Companies, and is intended for clearing the Fleetwood Bar. The vessel has been built to Lloyd's highest class. The christening ceremony was performed by Miss Bayley, daughter of Mr. C. W. Bayley, secretary of the Lancashire and Yorkshire Railway Co.

Texas.—On March 16th Messrs. Charles Connell & Co. launched, at Scotstown, the steel screw-steamer *Texas*, to the order of Messrs. Robert Mackill & Co., for the United Steamship Co. of Copenhagen. Her dimensions are:—Length, 375 ft.; breadth, 50 ft.; depth, 28 ft. 8 in. moulded; with a deadweight capacity of about 7,000 tons. She has been built to Lloyd's highest class, with a cellular double bottom right fore and aft for water ballast. The engines, which are of the most approved triple-expansion type, have cylinders 25 in., 41 in., and 67 in by 48 stroke, worked by two single-ended boilers, and are being *constructed by Messrs.* David Rowan & Son, Glasgow.

LAUNCH—IRISH.

Winifredian.—On March 11th a large screw steamer was launched by Messrs. Harland & Wolff, at Belfast, for Messrs. Frederick Leyland & Co.'s Atlantic cargo, cattle, and passenger service. The vessel is 552 ft. long by 59 ft. beam, and with about 10,560 of a gross tonnage. She will have triple-expansion engines, constructed by the builders, and will be fitted with electric light, and have all the most modern appliances for working ship and cargo. The ceremony of naming the vessel the *Winifredian* was performed by Miss Martin, daughter of the general manager of the line.

LAUNCH—GERMAN.

Secunda.—On March 7th the Flensburg Shipbuilding Co. launched from their shipbuilding yard at Flensburg, a new steel screw cargo steamer they are building for the Flensburger Dampfschifffahrt Gesellschaft vor 1869. The vessel is 270 ft. between perpendiculars by 39 ft. beam by 18 ft. 2 in. moulded depth, built to German Lloyd's 100 A, and is to carry about 3,000 tons. Accommodation for the officers is contained in a steel house built on top of bridge deck amidships, the crew being berthed in forecastle. She is a partial awning deck boat fitted with steam windlass, steam capstan, steam steering gear and four powerful steam winches. The engines being supplied by the Flensburg Shipbuilding Co., are of the triple-expansion type with cylinders 19 in., 31½ in., 51 in., by 36 in. stroke. The vessel was christened *Secunda* by Miss Clothilde Danielseu.

TRIAL TRIPS.

Pendeen.—On February 23rd Messrs. William Gray & Co., Limited, sent to sea for her trial trip the s.s. *Pendeen*, which is the fifth vessel they have built and engined to the order of Mr. R. B. Chellew, of Truro (of which we gave full particulars in our launch columns, December issue, page 371). A very satisfactory run was made, the vessel on its conclusion proceeding to Venice to load.

Inchmaree.—On February 23rd this vessel (one of the fleet of Messrs. Hamilton, Fraser & Co., of Liverpool) also left the port after undergoing extensive overhaul and renewal of some parts of the machinery at the hands of William Gray & Co. Everything passed off very satisfactorily.

Woodford.—On Thursday, February 23rd, the s.s. *Woodford*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of the Britain Steamship Co., London (of which we gave full particulars in our columns, February issue, page 473), made her trial trip in the Tees Bay, which was quite satisfactory in every way, and the day being exceptionally fine, the trip proved very enjoyable to the visitors and others on board. The owners were represented by Mr. James Spence, under whose supervision the steamer has been built, whilst the builders were represented by Mr. Leonard Ropner. After adjustment of compasses, the steamer proceeded on her run round to Cardiff, where she will load.

Cardiganshire.—On February 25th the new screw steamer *Cardiganshire*, being the third vessel built to the order of Messrs. Jenkins & Co., Limited, of London, for their Shire Line of steamers, by the Sunderland Shipbuilding Co., Limited (of which we gave full particulars in our launch columns, March issue, page 512), was taken to sea for her official trial trip, and was in every way most satisfactory, a mean speed of 11½ knots being obtained on the measured mile, after which the vessel left for Middlesbro', where she takes in the first portion of her cargo for Japan.

Claverdale.—On February 25th the s.s. *Claverdale*, built by Messrs. Craig, Taylor & Co., Stockton-on-Tees, for Messrs. Edmund Haslehust & Co., of London (of which we gave full particulars in our launch columns, January issue, page 429), proceeded to sea for her trial trip. Throughout the whole of the trip the engines worked with the greatest smoothness, and on the run from the Tees to the Tyne a speed of 11½ knots was maintained. Mr. Hewlett, of the firm of Messrs. E. Haslehust & Co., expressed himself as being highly pleased with both the hull and engines, as also did Mr. Barringer, of the firm of Messrs. Jacobs & Barringer, the consulting engineers of the owners. Captain John Barker, who has superintended the construction of the hull and outfit, has taken command of the vessel, which was taken into Tyne Dock to load for Genoa.

Newcastle.—On February 25th the s.s. *Newcastle*, which has been built by C. S. Swan & Hunter, Limited, to the order of the Newcastle Steamship Co., Limited, of Newcastle, managed by J. J. & C. M. Forster (of which we gave full particulars in our launch columns, February issue, page 475), was taken out to sea for her trial trip. A mean speed of 10½ knots was attained on the measured mile, which was considered highly satisfactory, after which the vessel was taken into Blyth, where she loaded her first cargo, and sailed the following week for Alexandria.

Saint Kilda.—On February 25th the new steel screw steamer *Saint Kilda*, built by Messrs. Archd. McMillan & Son, Limited, Dumbarton, for Messrs. Rankin, Gilmour & Co., Liverpool, went down the Firth of Clyde on her trial trip. The dimensions of the vessel are 340 ft. by 45 ft. by 28 ft. 9 in., and the machinery has been supplied by Messrs. D. Rowan & Son, Glasgow. On the completion of the trial, which was in every way satisfactory, the vessel proceeded to Barry, where she is to road.

Silesia.—On February 25th the s.s. *Silesia*, which has been built by Messrs. Wigham Richardson & Co., at their Neptune Works, Newcastle-on-Tyne, for the Austrian Lloyd's Steam Navigation Co., Trieste (of which we gave full particulars in our launch columns, January issue, page 428), having very successfully completed her trials, sailed from the Tyne for Venice. On the trials the owners were represented by Mr. Smith, as well as by Mr. Vecchi, under whose superintendence the vessel, with her engines and boilers, has been built. The *Silesia* is commanded by Capt. Mayer, one of the most experienced captains in the Austrian Lloyd fleet.

Bardsey.—Lately the steamship *Bardsey*, built by Messrs. Richardson, Duck & Co., for Messrs. Farrar, Groves & Co., of London (of which we gave full particulars in our launch columns, March issue, page 513), had her trial trip. The vessel attained a speed of 11½ knots per hour, and this result, together with the whole arrangements of the vessel, met with the approval of the owners. The *Bardsey* has a deadweight carrying capacity of 5,800 tons.

Derwen.—Lately the new screw steamer *Derwen*, built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. W. H. & C. T. Jones, Cardiff (of which we gave full particulars in our launch columns, February issue, page 476), has been to sea on her official trial trip.

Feronia.—On February 25th the s.s. *Feronia*, built by Messrs. W. Harkess & Son, of Middlesbrough, to the order of Messrs. Pile & Co., of London (of which we gave particulars in our launch columns, February issue, page 476), went out on trial from the Tees. The engines, which are of the triple-expansion type, have cylinders 14 in., 22½ in., and 37 in. diameter by 27 in. stroke. Steam is supplied by one extra large steel boiler, also constructed by the builders, to pass Lloyd's special survey and German law requirements for a working pressure of 160 lbs. per square inch. After adjusting compasses the vessel headed north, the passage between Hartlepool and the Tyne being accomplished at a speed of about 10½ knots.

Raithwaite —On March 2nd the large steel screw steamer *Raithwaite* had her trial trip in Hartlepool Bay. She has been built by Messrs. Wm. Gray & Co., Limited, of West Hartlepool, to the order of Messrs. The Pyman Steamship Co., Limited, of West Hartlepool (of which we gave full particulars in our launch columns, March issue, page 512). The vessel went out about six a.m., and after adjustment of compasses by Mr. Berry, was manœuvred to test her capabilities. Her speed, as registered by the patent log, was about 12 knots, and her performance in every respect highly satisfactory. The owners were represented by Mr. T. W. Smyth and Mr. W. Cromar, the shipyard by Captain Murrell, and the engine works by Mr. W. C. Borrowman. The vessel proceeds to Cardiff to load for Colombo.

Gertrud.—On March 4th the new cargo and passenger steamer *Gertrud* run a very successful trial trip in the Flensburg Bay. The *Gertrud* has been built by the Flensburg Shipbuilding Co., to the order of the Neue Dampfer Compagnie, in Stettin. She is a duplicate of the s.s. *Elsa*, and intended for the Baltic trade. The principal dimensions are:—Length, overall, 208 ft.; breadth, extreme, 29 ft.; depth, moulded, 14 ft. 1 in.; classed at German Lloyd's 100 A, and carries about 800 tons. She has been fitted with passenger arrangement below deck, officers' berths above bridge, and crew space in topgallant forecastle. Steam windlass and steam winches and De Voss patent lowering gear for lifeboats is arranged on bridge deck. The engines have been built by the Flensburg Shipbuilding Engineering Department, and are of the compound type, with cylinders 23 in. and 42 in. by 27 in. stroke. They worked very smoothly throughout the trial, and gave the vessel a speed of 10 knots.

Spithead.—On March 7th the screw steamer *Spithead*, built by the London and Glasgow Engineering and Shipbuilding Co., Limited, for the Clyde Shipping Co.'s ocean-going fleet (of which we gave full particulars in our launch columns, March issue, page 516), proceeded down the river on her trial trip, when everything worked most satisfactorily, and the vessel proceeded the same afternoon for Cardiff to load for the East.

Bardistan.—On March 9th this vessel had a very successful trial trip. She is a fine steel screw steamer 285 ft. in length, 41 ft. 6 in. in breadth, and 20 ft. 2 in. in depth, and is the seventh vessel built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, to the order of Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. She has been built to Lloyd's highest class. Her deck erections consist of poop, raised quarter deck, bridge, and topgallant forecastle. The saloon and accommodation for captain and officers are fitted in the poop, the engineers' berths are amidships, and the crew's quarters forward. The vessel is built with bulb-angle frames, cellular double bottom, and after-peak ballast tanks, steam winches, patent donkey boiler, steam steering gear amidships, screw gear aft, steam windlass, schooner rig with telescoping masts, boats on beams overhead, etc. The engines are of the triple-expansion type, supplied by the Central Marine Engine works of Wm. Gray & Co., Limited, and have cylinders 21½ in., 34 in., and 57 in. diameter, with a piston stroke of 39 inch. There are two steel boilers working at a pressure of 160 lbs. per sq. inch. The vessel went out about noon, and after being manœuvred to the requirements of Mr. Berry for the purpose of adjusting compasses, was tested for speed, etc., her average performance with the log overboard being about 10½ knots. The owners were represented by Mr. Hay, assistant inspecting engineer to the firm, the shipbuilders by Captain Murrell, and the engine builders by Mr. W. C. Borrowman. The vessel proceeds to Barry to load for Algiers.

Degama.—On March 10th the fine steel screw steamer *Degama* proceeded on her official trial trip in Hartlepool Bay with a large number of visitors and officials on board. The vessel has been built by Messrs. Furness, Withy & Co., Limited, to the order of Messrs. Elder, Dempster & Co., of Liverpool, (of which we gave full particulars in our launch columns, February issue, page 475). The engines ran very smoothly during the trial, and the vessel attained a speed of 11½ knots. Mr. T. H. Smith represented the owners, and Mr. G. W. Sivewright the builders. After the trial the vessel proceeded to the Tyne.

Kum Sang.—On Saturday, March 11th, the fine steel screw steamer *Kum Sang*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, to the order of Messrs. The Indo-China Steam Navigation Co., Limited, of London (of which we gave full particulars in our launch columns, February issue, page 476), was taken out to sea under the command of Captain J. M. Hay, for her official trials. Mr. Cheyne, secretary of the Indo-China Steam Navigation Co., Mr. Roberts the superintendent engineer, and Mr. Barrett, resident inspector for the company, were on board during the trials which passed off most successfully, and the vessel afterwards proceeded to Blyth to load.

Solo.—On March 11th the steamer *Solo*, which has been built by Messrs. Wigham Richardson & Co., to the order of the Rotterdamsche Lloyd of Rotterdam, went for a very successful trial trip off the mouth of the river. The *Solo* is built of steel, to the highest class in the Registry of the Bureau Veritas. She is 333 ft. long by 44 ft. beam, is rigged as a two-masted schooner, and has very comfortable accommodation for a limited number of passengers. During the trial the machinery worked without the slightest hitch, giving satisfaction to all concerned. The owners were represented on the trial trip by Mr. W. Ruys, head of the firm of W. Ruys & Sons, managers of the Rotterdamsche Lloyd, and there were also present Mr. A. Ruys, Mr. J. de Bruyn Kops, naval architect, of the Hague, under whose superintendence the steamer has been built, and Mr. Atkins, of Rotterdam, who superintended the construction of the engines and boiler. After the trial the steamer sailed for Rotterdam under the command of Capt. Engelsman.

Muristan.—On March 14th the new steel screw steamer *Muristan*, which has been built by Messrs. Wood, Skinner & Co., Limited, Bill Quay-on-Tyne, to the order of Messrs. F. C. Strick & Co., London (of which we gave full particulars in our launch columns, February issue, page 474), left the Tyne for her official trip, during which the machinery worked without a hitch, and gave every satisfaction to the company on board, which included Mr. Martin, representing the owners, and Mr. J. S. Wood the shipbuilders, Mr. S. Hunter for the engine builders, and Mr. A. Walker, of London, who, assisted by Mr. Hay, has superintended the construction of both ship and machinery. After the trial the vessel proceeded on her voyage to London, where she will load her first cargo.

Anna.—On Wednesday, March 15th, the steel screw steamer *Anna* left Messrs. Craig, Taylor & Co.'s shipbuilding yard, Thornaby-on-Tees, for her trial trip, which proved highly satisfactory. The leading dimensions are 299 ft. by 43 ft. 2 in., by 21 ft. 3 in. depth, moulded. She is of the single-deck type, to Lloyd's highest class, and is constructed to carry about 3,550 tons deadweight on a light draught of water. The captain's, officers', and engineers' accommodation is all placed amidships, the crew being in the forecastle. She is fitted with deep frames throughout, and has large cubic capacity; also water ballast fore and aft, and in peaks. The deck machinery consists of four large steam winches, steam windlass, steam steering gear, large donkey-boiler, screw gear aft, &c. She is rigged as a fore-and-aft schooner, with telescopic masts, and is also supplied with stockless anchors, &c. The engines, which were by Messrs. T. Richardson & Son, Limited, of Hartlepool, are of the following size, viz., 22 in., 35 in., 59 in. by 39 in., with two large boilers. During the whole of the trip they worked without the slightest hitch, running with the greatest smoothness, and a speed of twelve knots was maintained. The vessel has been built for Messrs. Fratelli Cosulich & Co., of Trieste, who were represented on the trial trip by Mr. Callisto Cosulich, this gentleman expressing himself as being highly pleased with both the ship and engines. The vessel afterwards left for Hamburg, under the command of Captain Antonio N. Cosulich. She will load in Hamburg for the far East.

H.M.S. Kestrel.—On March 15th and 17th the Clydebank Engineering and Shipbuilding Co. successfully carried out the trials of the the torpedo-boa destroyer *Kestrel*. On the 15th the *Kestrel* went for the official coal-consumption trial at full speed for three hours, and on the 17th the official full-speed trial took place. Six runs were made on the measured mile at Skelmorlie, giving a mean speed of 30·406 knots. The vessel subsequently completed the three-hours trial, which finished near Skelmorlie at 3.15 p.m. After the speed trial, stopping, starting, and steering trials were made. The Admiralty were represented by Messrs. Welch & Wisnom, overseers, and officials from Portsmouth Dockyard were also on board.

Ludvig Peyron.—On March 17th the s.s. *Ludvig Peyron*, built by Messrs. Carmichael, Maclean & Co., Greenock, for the Stockholm Company (of which we gave full particulars in our launch columns, December issue, page 374), went on her trial trip on the Clyde, and attained a mean speed of 9½ knots, with 1,700 tons of cargo on board, on 16 ft. draught. The coal consumption was 1·43 lbs. per I.H.P., which was considered highly satisfactory by the owners' representatives. Messrs. Muir & Houston, Limited, of Glasgow, supplied the vessel with triple-expansion engines, cylinders of 18 in., 30 in., and 48 in. by 33 in. stroke.

Correspondence.

[*We do not in any way pledge ourselves to the opinions preferred under this heading.*]

SPEEDS AND COAL ENDURANCE.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—With reference to the statement in your article on the new *Oceanic* in your last issue, that she and the *Teutonic* have the largest coal endurances in the world, I have seen it *stated elsewhere that* the Orient Line s.s. *Ophir* and *Omrah* *could keep the sea without recoaling for periods* of 130 and 150 days respectively at a cruising speed of 10 knots per hour. Would you kindly inform me whether this is so? Though not a marine engineer by profession, I take a great interest in matters maritime, and I am indebted to your paper for much valuable information concerning shipping.

Could you inform me what ship holds the record (*a*) for a passage and mail delivery from Plymouth to Adelaide; (*b*) for a passage from Adelaide to Plymouth?

I *believe* the *Ophir* of the Orient Line holds the outward *mail* record with 24 days 2 hours, but have no certain information as to the passage from Adelaide to Plymouth.

I notice the new steamer *Omrah* of the same line has just made a good run from Suez to Perim. Leaving the Canal at 10 a.m. on Friday last, she passed Perim yesterday at 1 p.m. *i.e.*, 3 days 3 hours for a distance of 1,211 miles, making an average speed of 16·146 knots per hour! Is this also a record? If not, at least it is considerably faster than the usual rate of progress in these waters, which is usually about 14 knots an hour.

I see the *China* has just left Port Said for Belfast, where, I suppose, Messrs. Harland & Wolff will repair her, but I presume she will not take her place in the P. & O. fleet again, as a mail boat?

Apologising for troubling you, and thanking you in anticipation,

I am, sir,
Yours faithfully,
S. L. BROAD.

Old Christchurch Road,
Bournemouth East,
February 21st, 1899.

Our correspondent asks a number of questions, most of which it is practically impossible to answer, we fear. The *China* has been temporarily repaired afloat at Perim, and only reached Belfast on the 18th March. Till she has been dry-docked and thoroughly examined by the builders and experts it is impossible for even her owners to answer the question as to her future. The question as to the mail record between Adelaide and Plymouth is not one that could be easily answered, for the vessels of the Australian lines do not go fast after they have discharged their mails on the homeward run at the Mediterranean port or before they have shipped them there on the outward trip. The fair test is the run to the mail port in the Mediterranean, or the time of mail transit to London. Each new ship when she comes out usually makes a run to show her paces, and then subsides into a jog trot, merely keeping her contract time and easing down if she is getting ahead of her time. As regards the coal endurance question, the statements published concerning the *Oceanic* and the *Teutonic* and the *Ophir* and *Omrah* are merely owners' and builders' statements. It is impossible for an outsider to check them. Only those well acquainted with the vessel know what her consumption at cruising speed would be per diem. Then, even if he knew that, he could not find out how much extra bunker space is reckoned in the provision for this long sea keeping. It is, however, probable that the *Oceanic*, whose cruising speed will be higher than that of the other ships named, will certainly have the greatest coal endurance.—ED. M.E.

Miscellaneous.

Catalogue.—We have just received a new illustrated catalogue which has been issued by Messrs. Fleming, Birkly & Goodall, Limited, of West Grove Mill, Halifax, and 39, Lime Street, London, E.C., which gives full particulars with reference to the large assortment of goods which they manufacture and supply. These comprise practically all the types and sorts of belting upon the market, and the various fastening devices for same, and apparatus for stretching the belts when making the joints. All the usual forms of hydraulic leathers, various washers of different materials, and delivery hose and fire appliances are listed. And, lastly, we would refer to steam and other packing, which is illustrated and fully described in this catalogue. It is in a convenient form and of a handy size for ready reference, which is a useful characteristic.

We understand that Messrs. Thos. Firth & Sons, Limited, Sheffield, the well-known firm of steel manufacturers, have appointed Messrs. Echalay, Laith & Co., of Newcastle-on-Tyne, to be sole agents in the North-East Coast district for all their manufactures.

Ventilation of Ships.—An interesting test of a 30 in. electric Blackman fan has been made on board one of the Laird Line steamers. The *modus operandi* was as follows:—All the openings in the hold were closed, and two heaps of refuse ignited for the purpose of filling the space with smoke. This, in a short time, got so dense that the electric lights were invisible at a distance of 20 ft. The fan was then set in motion, and in less than three minutes the atmosphere in the hold was perfectly clear, thus demonstrating that the whole of the air had been renewed in that short period of time. Since the experiment above described was made the following observations, which are worthy of note, have been taken in connection with a 16-hours' voyage. There were 110 head of cattle stowed in the hold, this being the full number allowed, and during the entire passage the thermometer never registered more than 60 deg. Owing to the vapour given off by the cattle being removed by the fans as quickly as produced it was possible to see from one end to the other during the whole of the time. The temperature before the cattle were taken on board was 50 deg. The directors of the Laird Line are so pleased with these results that orders have been placed for fans for the ventilation of the holds of some other vessels of their fleet. These are being fitted up under the superintendence of the engineers of the Blackman Ventilating Co., Limited, 162, Hope Street, Glasgow.

Wailes, Dove & Co. was registered on March 9th with a capital of £38,000, in £1 shares (15,000·5 per cent. cumulative preference), to acquire and take over as going concerns, and carry on the business of a manufacturer of enamels, solutions, tank-top coverings, cement, paints, and compositions for the protection of steel and iron now carried on by Edward J. Dove at Newcastle-upon-Tyne as "Wailes, Dove & Co."; also of the business of a marine surveyor and naval architect now carried on by Edward Dove at Newcastle-upon-Tyne as "E. F. Wailes & Co." The subscribers are:—Edwd. J. Dove, Greystoke, Grainger Park Road, Newcastle, manufacturer; Mrs. Mary C. Dove, Greystoke, Grainger Park Road, Newcastle; Mrs. Mary W. Dove, High Park, Newcastle; David N. Brims, Spring Bank, Benwell, Newcastle, contractor; Chas. Macdonald, Brodrick Street, South Shields, naval architect; Jas. E. Muir, Derby Crescent, Kelvinside, Glasgow, engineer; Percy Hedley Chirton, Clifton Road, Newcastle, gentleman. The number of directors is not to be less than three nor more than five; the first are Edwd. J. Dove, David N. Brims, Chas. Macdonald, and Jas. E. Muir; qualification, £500; remuneration as fixed by the company. The company is a semi-private one, a few prospectuses only being sent out to friends and customers of the firm.

Shipbuilding at Campbeltown—Though Campbeltown, on the East coast of the long peninsula of Kintyre in Western Scotland—of which part of Scotia it is, of course, the industrial capital—is more famed for its output of "strong waters"—in the way of whisky—than for its production, and consignment to their native element, of merchant ships; it can nevertheless boast of its achievements in the latter branch of industry as well. The Campbeltown Shipbuilding Co., entrenched as they are on French Point, within the land-locked bay or lock of Campbeltown, are exceptionally situated, so far as launching accommodation and steady plodding industry on the part of their employees are concerned, and this year already they have launched two steamers, and still have their fine building berths occupied. Three steamers are at present on the stocks—two of them near the plating stage of construction—and the keel of a fourth is about to be laid. This is on the berth vacated about a month ago through the launch of the screw steamer *Gorbea*, which is being engined by Messrs. Hutson & Sons, of Kelvinhaugh Engine Works, Glasgow, and will shortly run her speed trials on the Firth of Clyde. Though handicapped without doubt in various ways by reason of its isolation from industrial and shipping centres—the facilities for procuring and transport of material, for instance, as well as for the "dropping in" of owners' agents, consulting engineers, &c., being limited, to say the least—it is pleasing to note that the Campbeltown Shipbuilding Company is meeting with the success that is born of enterprise and satisfactory workmanship. The isolation referred to is not without its advantages, especially where sufficient enterprise and perspicacious gauging of the prospective needs of the shipping industry are to the front. These qualities seem to be "all there" at Campbeltown, and as a matter of fact, though most of the vessels the company produce are what are known as "spec" boats, seldom, if ever, are owners waiting when once the launching stage has been reached.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from February 8th to March 8th, 1899.

2790 G. Achterberg. Boats.
2815 R. Wilby. Regulating engine speed.
2820 J. H. Gadd and W. Harrop. Steam boilers.
2844 F. E. and F. O. Stanley. Steam generators.
2856 W. H. Kitto. Internal combustion engines.
2866 G. H. Biddles and S. W. Wilkinson. Engines.
2882 T. H. Brough. Steam generators.
2935 J. T. Kellett. Internal combustion engines.
2980 F. Davidson and J. Summerville. Wrenches.
3006 E. B. Cullen. A propeller for steamers.
3008 A. J. Boult (F. J. Mobbs, United States). Nut lockin device.
3034 W. J. Stephens. Lubricators.
3092 F. B. Smith, S. W. Royse and E. E. Douat. Pumps.
3107 C. A. Parsons. Feed-water heaters.
3117 S. S. Krausz and S. Marton. Piston rings.
3138 F Niepmann. Rotating steam engines.
3180 J C. Howell. Friction gearing.
3232 J. G. Foster. Steering apparatus for vessels.
3264 J. S. K. Anderson. Steam trap.
3319 H. A. Ruggles. Tube cleaners
3347 R. Meldrum. Wind-scoop for ports of ships.
3395 F. Rossdeutscher. Preventing cranes overloading.
3401 J, F. Walters. Internal combustion engines.
3423 R. Hampson. Seats for boilers of ranges.
3434 J. L. Boothman and W. Hastie. Controlling engines.
3453 F. Hocking. Purification of feed-water.
3483 W. J. Roberts and J. R. Jones Utilizing tidal power.
3499 V. Vecchi. Rendering boats uncapsizeable.
3505 E. H. Taylor and J. Firth. Water valves.
3513 E. S Barzee. Double-acting pumps.
3517 W. F. Reynolds. Expanding friction clutches.
3528 F. Reichenbach. Igniting combustion engines.
3535 J. Jackson. Automatic lubricator.
3544 H. R. Angel. Steering ships without a rudder.
3563 E. Molas, E. Lamielle and A. Tessier. Screw-down valves.
3587 J. Van Overklift. Indicating the points of the compass.
3601 C. White. Fishing tackle.
3614 E. Carver. Thrust bearing.
3623 J. Menzies. Piston packing rings.
3655 E. Rae. Propelling yachts.
3656 R. D. Griffiths. Model ships.
3668 H. J. Houston-Wilson. Rivets and bolts.
3673 A. J. Balkwill. Valves for steam engines.
3680 F. A. S. King. Compressed air wreck raiser.
3733 A. Hemsted. Artificial bait for fishing.
3747 W. J. Murphy. Buoys.
3751 C. S. Olsson. Davits.
3752 M. F. Gutermuth. Valve gear for engines.
3766 P. R. J. Willis (J. Provuncher, United States). Steam generators.
3770 R, Haddan (H. Schuppmann, Germany). Boilers.
3776 C. Hass. Governing marine steam engines.
3777 S. O. Cowper-Coles and the Reflector Syndicate, Limited. Reflectors.
3812 J. Menzies. Piston packing rings.
3820 J. L. H. Slater. "Tube expanders" for boilers.
3823 A. B. Hay, W. Rennie and W. Muir. Smoke-consuming apparatus for steam boiler furnaces
3830 L. S. Bickley. Buoyant clothing for life-saving purposes
3849 R. E. B. Crompton. Gearing for driving pumps.
3888 J. A. Fletcher and S. Fletcher. Water gauges.
3901 M. Clausnitzer. Steam generators.
3919 A. Godfray. Propeller.
3926 R. L. Crawford Torpedoes.
3948 C. D. Abel (The Gasmotoren Fabrik Deutz, Germany.) Piston.
3953 F. M. Rites. Steam engine governors.
3958 S. A. Greene. Screw steamer propeller.
3967 T. Owen. Towing vessels.
3971 J. Spedding. Hoisting apparatus for boats.
3985 J. D. Churchill. Ships' steering apparatus.
3986 W. J. Murphy. Sextants.
3987 W. F. W. Ellis. Propelling torpedo-boats.
3991 C. E. Mumford. Furnace doors.

4010 F. O'C. Prince and C. E. Monkhouse. Directing torpedoes.
4038 H. Parsons. Internal combustion engines.
4079 A. Mitchell. Friction clutches.
4095 J Price. Unloading the cargoes of ships.
4101 W. Dewar. Tool for closing metallic rings.
4149 J. Radcliffe. Feed water heaters.
4150 J. Radcliffe. Condensers for condensing steam.
4201 J. Archibald Coverings for steam boilers.
4206 D. Croll. Steam generators.
4208 E. Sharples. Anchor.
4219 I. S. McDougall and N. N. Haigh. Steam trap.
4225 W. Hay and E. Hotchkiss. Lubricating pistons.
4258 F. Brown. Steam engine packing boxes.
4267 G. Wallace. Packings for piston rods.
4281 F. E. Jorden. Purifying and heating water.
4288 R. Riddle. Friction clutches.
4291 Tangyes Limited and J. N. Floyd. Steam pump.
4309 C D. Abel (La Compagnie Anonyme Continentale pour la Fabrication des Compteurs a Gaz et autres Appareils, France). Apparatus for feeding boiler furnaces.
4310 J. C. Spence. Compound steam engine.
4330 W. B. Fitch. Utilising motion of ships.
4401 A. Granger. Boilers.
4429 A. F. Spooner (E. Aubrat, France). Centrifugal governors.
4464 J. Muir. Hand-steering gear for ships.
4469 W. A. Ashworth. Multiple expansion engines.
4479 W. H. Stephenson. Compasses.
4481 R. W. Hood. Seats for pleasure boats, &c.
4487 J. A. and S. Fletcher. Valves for boilers.
4488 R. K. Thompson. Internal combustion engines.
4538 P. R. Trethewey. Boat propelling mechanism.
4604 C. A. Bond and T. D. Smith. Quickly stopping ships.
4607 W. H. O'Hara. Dredging apparatus.
4639 L. Zamboni. Rivetting tools.
4644 H. H. MacTaggart and R. G. Scott. Hydraulic pumps.
4680 J. Schaefer. Packing pump-plungers.
4724 C. Eagle-Bott. Shipping docks.
4739 F. L. Lane. Flanged flues for boilers.
4745 E. W. Whitley. Friction clutches.
4752 D. B. Morison and J. S. Bonnyman. Expansion glands.
4757 W. Brierley. Cylinders for steam engines.
4765 C. T. B. Sangster. Friction clutches.
4781 J. T. Kellett. Friction clutches.
4782 J. Knaus. Propelling apparatus for ships.
4825 H. Weigelt. Imitating motion of ships at sea.
4826 E. Gearing. Boiler flues.
4827 F. L. Lane and The Leeds Forge Company, Limited. Flanged flues for boilers.
4860 J. Beaumont. Metallic packing.
4869 A. Koch. Propelling apparatus for boats.
4891 J. M. McLean and A. Sykes. Governors.
4895 A. Cooper. Trawl boards for deep sea fishing.
4926 A. Camilleri. Boat chocks.
4953 J. Killip. Steam engine governors.
4962 R. Coulson and T. Forsyth. Indicating speed.
4984 P. M. Justice (The Pope Manufacturing Company, United States). Engines.
4987 S. de la G. Williams. Self-locking screw nuts.
5005 W. G. Armstrong, Whitworth & Co., Ltd., and E. W. Lloyd. Fastening the doors of torpedo tubes.

BOARD OF TRADE EXAMINATIONS.

Note.—1C denotes First Class; 2C Second Class.

February 25th, 1899.

Adam, Wm. S. 2C Dundee
Adamson, J. I. 2C ,,
Airey, John .. 2C W. Hrtpl.
Allen, Thos. A. 1C N. Shields
Andreides, G. J. 2C Cardiff
Angus, Thos. .. 2C N. Shields
Bonner, T. H. 2C London
Bowen, R. G. .. 2C ,,
Boyd, James .. 1C Sthmptn.
Burnett, W. J. 1C Cardiff
Cairns, David .. 2C Glasgow
Caldow, John .. 2C ,,
Cartwright, W. 2C Cardiff
Cave, Henry .. 2C Sthmptn.
Chisholm, Rbt. 2C Dundee
Colledge, W. A. 1C W. Hrtpl.
Cook, Ed. W. 2C Dundee
Cunningham, J. 2C Glasgow
Darling, Robt. 1C ,,
Day, Ernest C. 1C Dundee
Dunning, Robt. 2C Liverpool
Dymock, James 2C Glasgow
Forrester, A. S. 2C London
Galloway, Rbt. 2C W. Hrtpl.
Gow, Harry .. 2C ,,
Gray, Geo. G . 2C Glasgow
Gray, John T.. 2C N. Shields
Gwyther, C. J. 1C Cardiff
Hartwell, G. T. 2C London
Henderson, Rt. 1C Dundee
Hosking, G. F. 2C London
Inverdale, J. B. 2C Glasgow
James, Anthny 2C Cardiff
Jones, Jmh. W. 2C ,,
Kent, Saml. N. 2C N. Shields
Lindsay, Geo. 1C W. Hrtpl.
Maddison, Ed. 1C ,,
Marshall, Ewd. 2C N. Shields
Maxwell, Stuart 2C ,,
M'Dougall, W. 1C Glasgow
Mearns, David 1C Dundee
Meyer, H. F. P. 2C Glasgow
Miller, James .. 1C ,,
M'Kechnie, Ad. 2C Liverpool
M'Millan, John 2C Glasgow
Moorhouse, W. 2C Liverpool
Neill, Hugh .. 1C Glasgow
Niven, Wm. .. 2C ,,
Noble, John C. 2C Liverpool
Pittas, John N. 1C Cardiff
Pollard, C. E. 2C N. Shields
Richards, Ths. 1C Cardiff
Ritchie, Jn. K. 2C London
Robb, Andrew 2C Glasgow
Robson, John 1C Liverpool
Shilton, J. R. 2C Glasgow
Smith, Joseph 2C London
Stewart, C. B. 1C Sthmptn.
Tannahill, F. J. 2C Glasgow
Torrance, Chs. 1C ,,
Watson, C. W. 2C Cardiff
Wherly, Alfred 2C W. Hrtpl.
Williams, G. N. 2C Liverpool.

March 4th.

Allan, John C. 1C Aberdeen
Bennett, Alexr. 2C Sun'rland
Binns, Walter .. 1C ,,
Bray, Chas. G... 2C Hull
Britton, Ed. T. 2C Bristol
Brown, Wm. E. 2C Aberdeen
Browne, Wal. V. 2C Liverpool
Chalmers, Peter 2C Aberdeen
Cullum, Wm. H. 1C Hull
Davidson, A. W. 2C Aberdeen
Davies, John C. 1C Liverpool
Dowse, Wm. A. 1C N Shields
Edwards, W. G. 2C ,,
Gibson, Thos... 1C Sun'rland
Hardwick, C. A. 1C Liverpool
Kidd, Andw. W. 2C ,,
Lidgerton, T. Y. 2C Sun'rland
Little, Wm. .. 2C Liverpool
Longfield, G... 2C Sun'rland
Mackenzie, Alex 1C London
McDonald, A. A. 2C Aberdeen
McFarlane, A. 2C London
McLean, F. .. 2C ,,
Menzies, J. D. . 2C Aberdeen
Mossman, Jn. J. 2C Liverpool
M'Pherson, Jhn 1C Sun'rland
Murray, W. L. 2C Aberdeen
Reid, Alex. L... 1C ,,
Ronaldson, Rd. 2C ,,
Scott, James W. 1C ,,
Seed, Thos. C. 1C N. Shields
Sterling, Rd. .. 2C Liverpool
Tate, Geo. B. .. 2C Hull
Topley, Albert 2C Liverpool
Vaughan, Albert 2C London
Wade, Albert E. 2C Hull
Watson, John .. 1C Aberdeen
Watson, John .. 1C Sun'rland
Wilson, Jas. M. 2C Aberdeen
Wilson, Wm. R. 2C Sun'rland

March 11th.

Addison, W. L. 1C Liverpool
Bailey, Jas. J.. 1C London
Baird, John C. 2C Liverpool
Bell, Mat. R. .. 1C N. Shields
Bowden, H. J. 1C London
Buchanan, T. 2C Glasgow
Burden, Jhn. H. 1C London
Campbell, H. 1C Glasgow
Cowen, Wm. W 2C London
Ellis, Hy. J. P. 2C Falmouth
Evans, Robt. L. 1C Cardiff
Fogg, George .. 1C ,,
Gordon, Alex. C 1C Glasgow
Hamilton, Thos. 2C ,,
Heckford, John 1C N. Shields
Houston A.M.C. 1C Glasgow
Jeffery, Wm. G. 2C London
Jones, Wm..... 2C Liverpool
Laing, Thos. D. 2C Glasgow
Leith, Henry .. 2C London
Lewis, David .. 2C Cardiff
Malcolm, Hugh 2C Belfast
Mathie, Alex. C. 1C N. Shields
McIlray, John 1C Glasgow
Minnikin, J. R. 1C N. Shields
Muir, Robt. M. 2C ,,
Naysmith, Jas. 1C Glasgow
Pace, David R. 2C ,,
Preston, James 1C ,,
Sievewright, A. 2C Cardiff
Stirrat, Mat... 1C Glasgow
Taylor, Jas. B. 2C ,,
Terry, Ernest 1C N. Shields
Thompson, B. 1C London
Todd, Walter 2C Liverpool
Toward, L. O. 2C N. Shields
Turner, D. J. 1C Glasgow
Turner, Thos. J. 2C London
Watt, John .. 1C Glasgow
White, Ar. R... 1C Cardiff
Whyte, Robt... 1C Glasgow

March 18th.

Allan, John .. 1C Greenock
Apsley, Wm. .. 1C Dublin
Baird, Jas. .. 1C London
Boswell, Fred. 2C Greenock
Brown, Robert 2C ,,
Cumberlidge, W. 2C ,,
Erskine, David 1C London
Filshie, James 2C ,,
Frost, Harold .. 2C Dublin
Gray, Geo. A... 1C Leith
Hattersley, Rob. 2C Liverpool
Innes, Wm. .. 1C N. Shields
Jardine, W. G. 1C Greenock
Kennaugh, T. T. 1C Liverpool
Kernaghan, S. 2C Dublin
Kerr, Wm. J. 2C Greenock
Madge, Wm. .. 1C London
Masters, H. H. 1C Liverpool
M'Intyre, A. L. 1C Greenock
Morton, Jas. .. 1C ,,
Mulhern, J. A. 1C ,,
Nicholas, W. 2C Hull
Nixon, Robt. J. 2C Dublin
Ormiston, H. T. 1C N. Shields
Osborne, Ral. S. 1C ,,
Ostens, J. W. 2C ,,
Owens, W. H. 2C Dublin
Roberts, Jas. 2C Greenock
Robinson, C. 2C N. Shields
Rowley, G. B. 2C Liverpool
Smith, Arthur 1C ,,
Smith, Wm... 2C Hull
Taylor, John.. 2C Dublin
Thornton, G. 2C N. Shields
Weatherall, C. 1C ,,

THE NEW YORK PUBLIC LIBRARY ASTOR, LENOX AND TILDEN FOUNDATIONS

The Marine Engineer.

LONDON, MAY 1, 1899.

MANY of the papers communicated to the Institution of Naval Architects necessarily are devoted to the consideration of stresses in a ship's structure, mainly interesting to those only who are engaged in the designing and building of ships' hulls. Such a paper is that contributed by Mr. J. Bruhn upon the stresses at the discontinuities in a ship's structure, which, however, is characterised by the attention given to the abnormal stresses set up in the plating about any discontinuities in the plating, such as hatchways and bridges. The author, after giving the usual and simple formulæ which serve to indicate the longitudinal and shearing stresses in a plain continuous hull, embodies these results in plain diagrams, showing, by the lightening and thickening of the stress lines, the general accumulation of the longitudinal and shearing stresses throughout the hull, assuming only one maximum bending moment. The results are interesting, graphically, to any reader, indicating the accumulation of the longitudinal strains in the upper and lower plating amidships, and the concentration of the shearing stresses in the central plating at distances about a quarter from either end of the vessel. A very distinct mental picture is also given of the general effect of all these superposed stresses under the various conditions of pitching or rolling by likening them to a network of stresses of which the meshes open and close as the moments vary. The exact calculation of the variable stresses produced about discontinuities, such as hatchways and bridges, presenting formidable difficulties, the author explains some very interesting experiments with sheet rubber of about ⅛ in. in thickness, cut so as to represent the discontinuity of hatchways and bridges, and strained to show by the elastic distortion of the surface the magnitude of the stresses about such discontinuities. The surface of the sheets were all lined out when in normal condition with fine parallel lines ¼ in. apart, both parallel to, and perpendicular to the direction of the pull, forming a complete set of squares, which, when the material was strained, became parallelograms. The elongation of these figures represented the strains, and the shearing strains by the alteration in the angles of the parallelograms. The results, when accurately measured, gave diagrams of the relative strains about such hatchways and the ends of bridges, naturally leading to direct information as to the character of the best doublings for a hatch corner, and for the best distribution of the thicker plating at the sides of the hatchways carried through continuously, and thinner plating between hatches, unless this distance was four times the width of the hatchways. In bridge stresses also important deductions are made, such as that the stresses increase with the length of the bridge, and larger in shorter than in longer wells, or higher in the way of narrow doors than in the way of broader ones. When a large amount of the material of the top sides is placed on the bridge, the shearing stresses at the end landings will be proportionately increased. The landings should be treble riveted, or a doubling plate should be joggled over the edge of the plate below to bring the rivets in double shear. As all structures are as weak as the weakest part, it is most important for ship architects to know from such information as this where the points of greatest stress lie, and how such extreme stresses should be dealt with.

OF a still more restricted scope were the notes communicated by Mr. C. F. Munday, serving to point out from the practical experience gained in the Royal Naval College, Greenwich, that a method of performing ship calculations to obtain cross curves of stability on a quadrature rule by M. Tchebycheff, and communicated in former transactions of the Institution by M. Kriloff, has proved to be much shorter than Simpson's method, and even more exact. The Russian method appears to be of great simplicity for the calculation of mid-ship and other cross-section areas, and also for water-line areas, thus giving displacement; but it is in using the rule with the integrator for cross curves of stability that the saving in time, and the reduction or avoidance of error by the simplicity of the calculations, are mostmarked to the advantage of the Russian method. It is at least strange to find that the Russians can teach something to British naval architects, but it is equally to the credit of the latter that they so readily admit this and profit by the suggestion.

MR. CHARLES H. HASWELL, from his vast range of experience, concludes some former reminiscences of the construction and operation of early steam-engines and steam navigation in the United States by a schedule of further interesting facts and steps in inventions and improvements introduced in the United States between 1807 and 1850. We cannot attempt to reproduce all the interesting steps of development indicated; but we may note that it was not until 1827 that any dry dock or marine railway existed in the United States in which, or on which, the bottom of boats could be cleaned of barnacles, breamed or metalled. When such operation was necessary, the hold was discharged, and large blocks and falls were led from her tops to a pier or bulkhead at low water and set taut. Then, as the tide rose, her outer side and bottom would be exposed and could be treated.

In 1842 Edwin A. Stevens, of Hoboken, designed and operated a closed fire-room in the steamboat *Rainbow*, supplied with air by a fan-blower located externally, and in 1845 the system was introduced in the United States steamer *Mississippi*. In the same year Captain John Ericsson applied screw-propeller blades to the sides of a steamboat like to a side wheel with diagonal blades, but they were not satisfactory. In 1844 Henry R. Worthington, of New York, designed and patented an independent steam fire and bilge pump, and in 1859 a duplex valve motor. In 1848 Frederick E. Stickles designed what is said to be the first application of a steam-engine to the rudder of a vessel, and successfully introduced it in operation.

WE are pleased to see that Mr. James Howden, so well known in connection with his forced draught system, still maintains his convictions that nothing can beat the Scotch or cylindrical boilers with a forced draught for marine purposes, and has the courage to express his convictions to the Institution of Naval Architects, in spite of the pseudo-fashionable craze for the water-tube boilers, and in spite of the fact that this author's ideas have not always been received with the attention that after experience has proved they merited. A good, healthy, and good-tempered opposition in engineering, as in politics, is always to be encouraged, and the old cylindrical boilers have been too long faithful and reliable servants to be discarded lightly, and without serious consideration. Mr. Howden, in dealing with torpedo-boat destroyers for sea service, of which so many are now being constructed, points out very reasonably that the destroyer, to be of protective service to an accompanying fleet, must be a sea-going vessel capable of keeping the sea in all weathers; or else an attacking fleet, when approaching a hostile port or coast, may be without the protection of the destroyers against the insidious attack of torpedo boats from the hostile port or coast. In support of these views Mr. Howden, quotes Mr. Dickie, an American engineer of great experience in naval construction, who has before him the tangible results obtained in the recent naval contests between the United States and Spain. Mr. Dickie is emphatic that the torpedo-boat destroyer, as at present constructed, does not come near meeting the requirements of sea-going service. Mr. Dickie therefore advocates torpedo-boat destroyers of 250 ft. length on the water-line, and 640 tons displacement, with a trial speed of 25 knots, which he reduces to 15 knots for Pacific sea voyage, or 20 knots for a coast voyage on the Pacific. This vessel would have a radius of action at 12 knots of 3,200 knots, and could keep the sea in all weathers. Mr. Howden, agreeing with the arguments of this gentleman as to the advantages to a fleet of such a sea-going torpedo-boat destroyer, goes one better, and asks whether a maximum sea-speed as 23½ knots is not sufficient for all practical purposes; and, if so, what is the use of hampering and vitiating the design by insisting upon such abnormal speeds as 25 or 30 knots an hour if the consequence is to prevent their utility as sea-going boats. With this slight reduction of maximum speed, which, however, is to be available at all times at sea, Mr. Howden gets in the claim for the cylindrical boilers and forced draught to be considered, with their well-known reliability and trustworthiness against sudden failure, and availability in all weathers with a small stoking staff, and with their well-known power for constant endurance at their maximum evaporation. With a 640 tons displacement, he shows that cylindrical boilers and forced draught for the suggested maximum sea speed of 23½ knots can be got in, and recommends the result as well worth the attention of the Admiralty.

THE horse-power absorbed by skin friction and wave making still appears to be wrapped in somewhat of a fog. Mr. James Hamilton has communicated some of his doubts and dilemmas on the subject to the Institution of Naval Architects, in his paper on the communications forwarded by Messrs. Inglis and Denny, and Professor Biles, on the subject of Mr. James Hamilton's paper on the horse-power absorbed by skin friction and wave making. Apparently specific examples do not appear to concur with Dr. Inglis's curve, as for instance the *Livadia* mentioned by Mr. Hamilton. As to Professor Biles's diagrams, Mr. Hamilton confesses he can make nothing of them, if they are what they profess to be. Mr. Denny has applied Mr. Hamilton's formulæ to six specific examples, with the result that the constant of

$$\frac{S^3\ D^{\frac{2}{3}}}{\text{I.H.P.}}$$

varies considerably in the various cases, and that without obvious reason, and even paradoxically. As an explanation, Mr. Hamilton points out that in all methods the efficiency of the propeller is assumed to be constant, and this is mixed up with skin friction, wave making, and engine friction. The conclusion arrived at by Mr. Hamilton is that, before such matters can be fairly analysed, the horse-power must be split up into its various parts, if only to discover the propeller efficiency in each case, and the engine friction.

Marine Engineers' Examination.—At the examination held on April 11th, 12th, and 13th, the following candidates passed for Extra First-class Engineers: Mr. A. Scott, of Liverpool, and Mr. T. Robertson, of Glasgow; the latter passing the first time of going up, and being prepared entirely by corresponpence. They were prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields, making 59 pupils who have passed in the above grade from this establishment, a number far exceeding that from any other existing school.

ORPEDO-BOAT BUILDING ON THE THAMES.

nuch to be deplored from a national point of view that Admiralty have not seen their way to place any of the new destroyers with one or more of the shipbuilding the Thames, since any slackness of work in these yards the loss of specially trained workmen, which loss cannot e good should a sudden demand for increased output necessary. The importance of this careful training ne home to the writer by watching the behaviour of a e torpedo-boat destroyer on which he had the pleasure ing a trial trip. Everything went "like clockwork,"

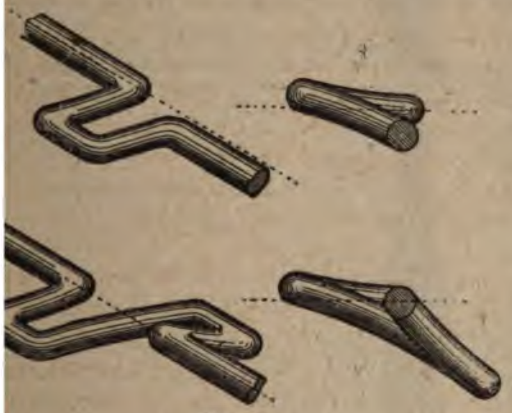
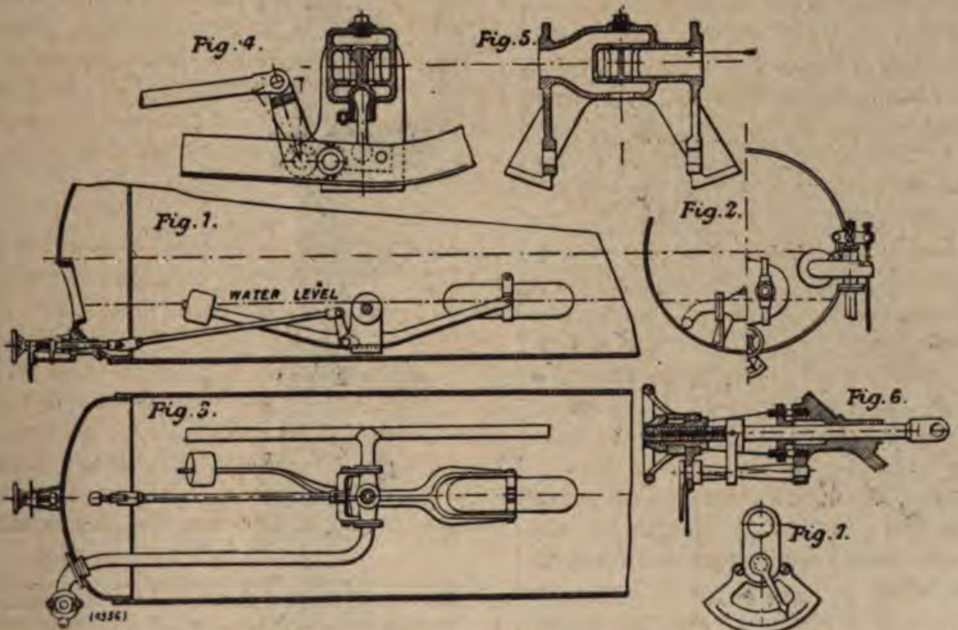


Fig. 1a.

s familiar phrase well expresses the excellence of the nship necessary to achieve such a result, and the necessity maintaining at their full efficiency the staff of such her builders, Messrs. John I. Thornycroft & Co., by their output at a steady and fairly high rate.

firm consists of two partners, one of whom, Mr. John on, who is, we regret to hear, seriously ill, has done good both in a public capacity as Chief of the Ordnance ent, at Dum Dum, in India, and in other appointefore, as well as in a private capacity since he became a in this now well-known firm. The other, Mr. John I. roft, is well known as a pioneer in the shipbuilding



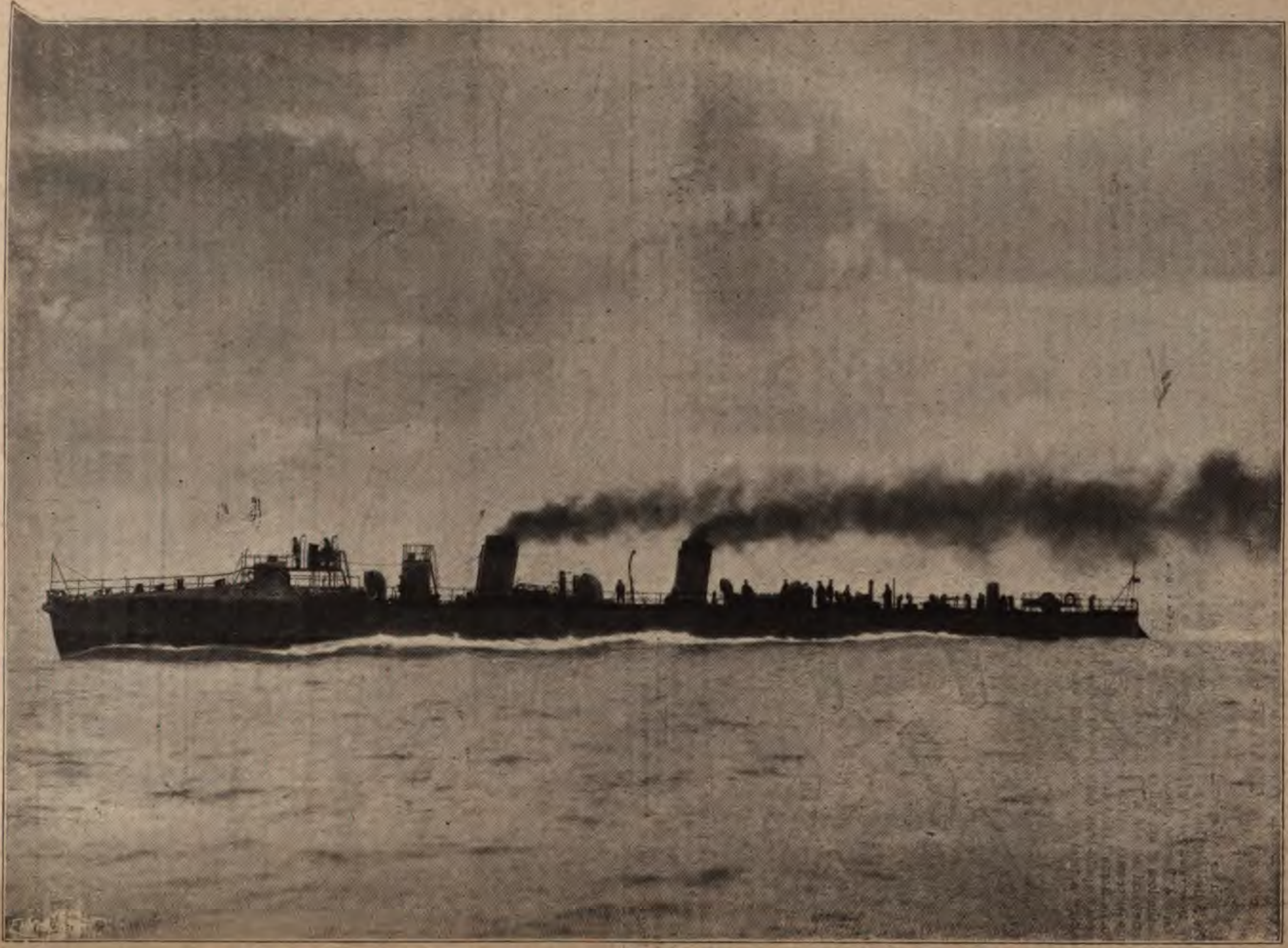
world. The late Chief Constructor of Her Majesty's Navy, Sir Nathaniel Barnaby, said in a recent lecture: "Out of the four great steps in speed-making which will make the last quarter of a century illustrious Mr. Thornycroft must be credited with three. Mr. Thornycroft in his several successes had given us a new form of boat, a new system of construction, a new form of propeller, and an effective way of generating steam by methods which had often been tried unsuccessfully and abandoned."

Mr. Thornycroft is a distinguished man of science and is one of the few engineers in England who have been awarded the Fellowship of the Royal Society, and the volumes of the Transactions of the Institution of Naval Architects and of the institution of Civil Engineers demonstrate that this honour has been well deserved. Both partners were distinguished pupils of the late Professor Rankine.

The small tube type of water-tube boiler, referred to by Sir N. Barnaby, did not find much favour with manufacturers and others until its merits were proved by the performance of the *Speedy*, which was fitted by Messrs. John I. Thornycroft & Co. with their patent boiler, with a result that this vessel developed 1,000 H.P. more than her sisters, which were fitted with locomotive boilers. Since then the small tube "express" boiler has rendered possible the 30 and 32 knot destroyers which are to-day being constructed throughout the world—mostly with boilers of Thornycroft type.

It was in 1885 that the Admiralty decided to build a number of vessels of the same size and speed as the torpedo boat, but with superior gun armament. Torpedo boats carried Nordenfeldt or Hotchkiss guns, firing steel shot between ½ lb. and 1 lb. in weight. The new catchers were to fire 3-pounder quick-firing shell guns and three two-barrelled Nordenfeldt guns. They were 125 ft. long, of 65 tons displacement, and with a guaranteed speed of 19 knots per hour. The speed was exceeded on trial by from 1 to 2 knots They were finally fitted out as torpedo boats.

In 1886 a new class of catcher of the *Rattlesnake* class was built. This boat was 200 ft. long, 23 ft. wide, of 550 tons displacement, engines 2,700 I.H.P., and speed 19 knots. The armament was a 4-in. gun and 6 three-pounder quick-firing guns, besides torpedo tubes. Then followed the *Sharpshooter* class—length, 230 ft.; beam, 27 ft.; and draught, 8 ft. 3 in.; engine, 4,500 I.H.P.; and speed, 21 knots. Locomotive boilers were fitted in them, and only 3,700 I.H.P. could be obtained, and a speed of 20 knots per hour. In 1892 eleven of the same class were built, with a displacement of 810 tons. They had locomotive boilers, developed 3,700 I.H.P., and attained a speed of 19½ knots. One of the eleven was the *Speedy*, and the builders, prevailing on the Admiralty to allow them to fit in their water-tube



THE JAPANESE TORPEDO-BOAT DESTROYER "MURAKUMO," BUILT BY MESSRS. J. I. THORNYCROFT & Co., CHISWICK, LONDON.

boilers, attained with them an increase of 1,000 I.H.P., and a speed of 20½ knots on trial.

Then came the *Daring* type of torpedo-boat destroyer, the speed of which was to be 27 knots. The *Daring* was 185 ft. long, 19 ft. beam, and draught 7 ft. The *Daring* attained a speed of 27·706 knots on trial, and the *Boxer*, of the same class, 29·175 knots. The last trial of the *Albatross* (on the 7th ult.) showed 32·294 knots per hour. We give a full page illustration of the Japanese torpedo-boat destroyer *Murakumo* (darkening clouds).

These high speeds require the greatest care to be taken in the balancing arrangements. The cylinders are inverted, and lie at an angle of about 12 deg., to the vertical. This admits of the cranks being brought close together without an intervening bearing; an arrangement which reduces to a minimum the disturbing couples which form so troublesome a feature in balancing problems. Two balance weights of moderate size only are found necessary, and certainly on the boat, even when going at 32 knots, the vibration is very slight indeed. The adjacent cranks are nearly opposite each other, and a model formed of a wire bent into the form of a crank, shown in the perspective view in Fig. 1a, shows a curious action when the wire is being twisted by means of a wooden disc at the end. When this is done there is only the twist transmitted to the wire at the other side of the cranks. With an ordinary crankshaft this is not so. The twist has in addition a lifting effect on the wire at a place where a bearing would be, and this would be followed by much friction. By arranging the cranks in the double form the friction, at an intermediate bearing, is obviated, and at the same time the pressure on the other bearings is greatly reduced.

On all trial trips water-service is provided for the wearing parts of the engines. The number of revolutions of the engines of the Japanese torpedo-boat destroyer being about 400 at full speed and the H.P. about 6,000, it can be understood that the effect of even a momentary increase of friction will be considerable. So water is used when necessary, and oil is supplied in plenty. The engine-room does not therefore appear to be the most pleasant place, or the craft of the engine-room artificer the happiest, in the world. It is in the closed stokeholds where things are entirely comfortable. The stokers seemed to be having an easy time of it, and almost doing their work sitting on their shovels. Certainly the atmosphere of the closed stokehold is not heated, the fan which produces the forced draught prevents that. One Japanese gentleman was sitting smoking cigarettes just in front of the furnace door in the most comfortable attitude possible. When the indiarubber-lined door of the stokehold was shut on us and we descended the stairs, we thought that something dreadful had to be undergone which in the interests of experience one had to suffer. The dreadful stories of the stokehold were in one's mind. The real experience gained was something very different. We wondered what it would be like when the trip was not a trial. If the interests of stokers are only to be considered, then the sooner the mercantile marine are fitted with small-tube water-tube boilers the better.

But, it may be asked, what about long voyages? Could the boilers be relied on to stand a long voyage? There was a torpedo boat, named the *Childers*, which had to be sent to Australia, in the early part of 1884, and the Admiralty, like other people, had its doubts about sending it so far a voyage alone. So a gun-boat was sent to take care of it and take it in tow. A storm came on, and the torpedo boat did not manage well in tow, the tow-rope broke and she got adrift. Those aboard the torpedo boat got up steam and went off to Australia and waited there for the gun-boat to come over. With the Japanese destroyers a speed of 200 revolutions and 20 knots is the easiest thing in the world to keep up as long as the coal lasts.

There is at the present time in the yard of Messrs. Thornycroft the racing yacht which will represent what England can do in the building of such craft. Considerable excitement has been occasioned by the attempts of outsiders to learn her construction and lines. These attempts have been unsuccessful. This vessel, the *Shamrock*, is to compete in the international yacht race between England and the United States, and if sound workmanship may do anything she will be sure to give a good account of herself. She has been designed by Mr. Fife.

Messrs. Thornycroft have very extensive shops at Chiswick, the number of men employed sometimes being as many as 2,000. The foremen and leading hands have been specially trained to their work, and some of them are known throughout the country as specialists. Mr. Milton, for example, informed the Institute of Naval Architects about the best manufacture of copper steam-pipes. The foreman coppersmith at the Chiswick yard knew everything about it long before, and was able to point out where Mr. Milton had not been correctly informed. There is a testing-room at Chiswick—a very essential part of the equipment of an engineering firm. The testing machine works up to 50 tons. The machine shop is very full, and a great number of the American quick-working tools have been introduced. There is a good forge with steam hammers for the small work, but the large forgings and iron or steel castings require to be made outside.

The Thornycroft water-tube boiler has been so much before the public of late in connection with the patent renewal case unfortunately unsuccessfully contested, and in connection with the record-breaking speeds of the destroyers, that it is almost superfluous to refer to it here. But, having seen the feed-regulator at work, and having seen it keep the level of the water absolutely constant, one is tempted to write a word about it. The figures representing this regulator are shown. Fig. 1 shows its elevation, Fig. 3 its plan. The principle is that of the ordinary ball-cock. There is the solid drawn-steel float held in the forked end of a lever. The float rises and falls with the water. The valve is shown in cross section Fig. 4, and longitudinal section Fig. 5. To regulate the quantity of water to suit the amount of steam being used, the vertical position of the fulcrum of the lever is altered. A hand wheel on the outside of the steam drum actuates the rod which regulates the amount of opening of the valve. Fig. 6 shows the piston, and Fig. 7 the front view of the indicator.

To hear some of those people with prejudices against small-tube water-tube boilers, one would get the impression that a tube was breaking down every few minutes, and that the fires were being raked out to allow of its renewal as often. There is a good story of one of the early boilers sent to work a mission launch on the Congo. It was sent out in pieces, and the man sent out to fit it up unfortunately fell a victim to the climate and died. The missionary, being an intelligent gentleman, got a little help from niggers, and built it in the boat, and it worked splendidly. Later, an engineer came out to the Congo with more prejudices than the missionary and the niggers. He condemned the boiler, took it out of the boat, and put in a vertical one in its place. The Thornycroft boiler was fitted up at a saw-mill, and when, after a year or so, the vertical boiler failed, the engineer anxiously applied to get the water-tube boiler back again, but the owner of the saw-mill would not part with it. Another Thornycroft boiler was therefore supplied.

TRIALS AND EXPERIMENTS MADE IN H.M.S. "ARGONAUT."*

By Sir John Durston, K.C.B., R.N., Engineer-in-Chief of H.M. Navy, Vice-President.

THE following paper gives an account of the results of the contract trials of H.M.S. *Argonaut* and certain experiments made while these were being carried out. Advantage was taken of the opportunity of making measurements of the actual water consumption of the engines under various conditions, with special measuring tanks fitted for this purpose.

The *Argonaut* is a twin-screw cruiser of 18,000 I.H.P.

The experiments were carried out on the specified contractors' trials, viz.: the thirty hours' trial at 3,600 I.H.P., a trial of the same duration at 13,500 I.H.P., and the full-power trial of eight hours at 18,000 I.H.P.

The engines are of the same dimensions and arrangement as those of the *Diadem*, described and illustrated in the paper read last year and given in our May, 1898, issue. They consist of two sets of triple-expansion engines arranged in separate engine-rooms divided by a middle line bulkhead, and are designed to develop the full specified power with an initial pressure at the engines of 250 lbs. by gauge. The boiler pressure is 300 lbs.

The diameters of the high, intermediate, and each of the two low-pressure cylinders are 34 in. 55½ in., and 64 in. respectively. The stroke is 4 ft., and the designed revolutions are 120 per minute, or ten more than the designed speed of revolution of the *Diadem*.

Each cylinder has a separate working barrel, which forms a steam-jacket with the cylinder walls. Steam may be admitted to these jackets and maintained at any desired pressure. The condensed jacket steam is led to collectors furnished with gauge

---

* [Read at the Fortieth Session of the Institution of Naval Architects, March 22nd, 1899; the Right Hon. the Earl of Hopetoun, G.C.M.G., in the Chair.]

TABLE I.—EIGHT HOURS' TRIAL AT 18,000 I.H.P.

	Position of Slide Gear.	Jackets in use.	Duration of Trial in Hours.	Revolutions per Minute.		Steam Pressures.																	Vacuum.		Temperature of Feed Water.		Cut-off in Cylinders (percentage of Stroke).								Total Expansion.	Indicated Horse-Power.			Water per Hour, in lbs., Main Engines.		
						Boilers.	Engines Reduced.		Receivers.						Jackets.												Starboard.				Port.										
									Starboard.			Port.			Starboard.				Port.																						
				S.	P.		S.	P.	H.	I.	L.	H.	I.	L.	H.	I.	F.L.	A.L.	H.	I.	F.L.	A.L.	S.	P.	S.	P.	H.	I.	F.L.	A.L.	H.	I.	F.L.	A.L.		Starboard.	Port.	Total.	Total.	Per I.H.P.	
C	Main Links Full Gear. H.P. Independent run in to get power.	All	2	129·6	128·6	299	236	241	234	92	33	241	97	32	217	112	54	53	216	115	62	60	26·0	25·4	114	116	71	67	46	46	71	67	47	46	8·5	9,605	9,441	19,046	316,990	16·64	C
B	Main Links Full Gear. H.P. Independent run in to get power.	L.P. only	3	130·3	128·2	290	242	244	241	92	35	244	98	33	—	—	55	54	—	—	57	57	25·8	25·7	115	113	71	67	46	46	71	67	47	46	8·5	9,712	9,234	18,946	305,527	16·15	B
A	Main Links Full Gear. H.P. Independent run in to get power.	Nil	3	129·0	127·4	292	236	237	236	92	35	235	96	32	—	—	—	—	—	—	—	—	26·0	25·2	113	117	71	67	46	46	71	67	47	46	8·5	9,535	9,246	18,781	295,718	15·75	A

TABLE II.—THIRTY HOURS' TRIAL AT 13,500 I.H.P.

	Position of Slide Gear.	Jackets in Use.	Duration of Trial in Hours.	Revolutions per Min.		Steam Pressures.																	Vacuum.		Temperature of Feed Water.		Cut-off in Cylinders (Percentage of Stroke).								Total Expansion.	Indicated Horse-Power.			Water per hour in lbs. Main Engines.		
						Boilers.	Engines Reduced.		Receivers.						Jackets.												Starboard.				Port.										
									Starboard.			Port.			Starboard.				Port.																						
				S.	P.		S.	P.	H.	I.	L.	H.	I.	L.	H.	I.	F.L.	A.L.	H.	I.	F.L.	A.L.	S.	P.	S.	P.	H.	I.	F.L.	A.L.	H.	I.	F.L.	A.L.		Starboard.	Port.	Total.	Total.	Per I.H.P.	
G	Main and H.P. Independent Links run in to get power	All	3	112·1	112·6	280	248	244	245	80	26	244	82	23	245	108	43	45	244	100	36	39	26·7	26·5	102	101	43	48	31	31	42	47	32	31	12·5	6,548	6,083	12,631	200,154	15·85	G
C	Main and H.P. Independent Links run in to get power	I.P. & L.P.	4½	116·3	117·7	280	235	235	232	79	27	235	81	25	—	109	43	45	—	101	44	44	26·6	26·6	100	104	54	57	38	38	52	56	39	37	10·4	7,200	7,079	14,279	226,548	15·87	C
D	Main and H.P. Independent Links run in to get power	Nil	4½	115·3	115·3	251	229	231	229	77	27	231	80	26	—	—	—	—	—	—	—	—	26·8	26·5	103	104	54	57	38	38	52	56	39	37	10·4	7,022	6,766	13,788	212,873	15·44	D
F	Main Links only run in to get power	Nil	4½	116·7	117·1	275	234	237	233	91	31	237	95	29	—	—	—	—	—	—	—	—	27·1	27·0	102	105	60	52	34	35	58	62	35	35	9·7	7,406	7,115	14,521	223,027	15·36	F
B	Main Links Full Gear. H.P. Independent right in ...	Nil	4½	116·9	116·4	287	191	187	187	64	27	186	64	22	—	—	—	—	—	—	—	—	26·6	26·4	101	102	65	67	46	46	65	67	47	46	9·1	6,874	6,682	13,556	216,422	15·97	B
A	All Links Full Gear...	Nil	4½	116·3	116·9	194	170	167	169	68	26	167	68	24	—	—	—	—	—	—	—	—	26·2	26·1	104	106	73	67	46	46	73	67	47	46	8·3	6,882	6,836	13,718	215,747	15·73	A
E	All Links Full Gear...	Nil	4½	116·2	116·5	232	181	179	179	70	27	179	69	25	—	—	—	—	—	—	—	—	26·8	26·2	104	106	73	67	46	46	73	67	47	46	8·3	7,021	6,792	13,813	224,092	16·22	E

TABLE III.—THIRTY HOURS' TRIAL AT 3,600 I.H.P.

	Position of Slide Gear.	Jackets in use.	Duration of Trial in Hours.	Revolutions per min.		Steam Pressures.																	Vacuum.		Temperature of Feed Water.		Cut-off in Cylinders (percentage of stroke).								Total Expansion.	Indicated Horse-Power.			Water per hour in lbs. Main Engine.		
						Boilers.	Engines Reduced.		Receivers.						Jackets.												Starboard.				Port.										
									Starboard.			Port.			Starboard.				Port.																						
				S.	P.		S.	P.	H.	I.	L.	H.	I.	L.	H.	I.	F.L.	A.L.	H.	I.	F.L.	A.L.	S.	P.	S.	P.	H.	I.	F.L.	A.L.		I.	F.L.	A.L.		Starboard.	Port.	Total.	Total.	Per I.H.P.	
A	Main and H.P. Independent Links run in to get power.	All.	5	75·6	76·2	285	165	167	163	48	9	166	52	9	159	73	31	30	159	69	29	29	26·0	25·8	110	110	28	34	23	23	26	31	23	22	15·7	1,906	1,877	3,783	61,749	16·32	A
B	Main and H.P. Independent Links run in to get power.	I.P. & L.P.	5	75·3	75·7	294	167	168	165	48	10	169	50	9	—	75	30	30	—	70	30	30	25·8	26·0	107	106	28	34	23	23	26	31	23	22	15·7	1,938	1,905	3,843	62,798	16·34	B
C	Main and H.P. Independent Links run in to get power.	Nil.	5	74·7	75·4	275	168	170	166	47	9	170	51	7	—	—	—	—	—	—	—	—	25·5	26·0	110	109	28	34	23	23	26	31	23	22	15·7	1,907	1,855	3,762	61,195	16·26	C
D	Main Link only run in to get power	Nil.	5	75·0	76·2	281	142	143	140	47	8	141	49	7	—	—	—	—	—	—	—	—	25·5	26·0	106	107	39	34	23	23	36	31	23	22	13·2	1,922	1,857	3,779	63,120	16·68	D
E	Main Full Gear. H.P. Independent right in	Nil.	5	76·7	77·4	285	78	75	76	17	2	75	18	1	—	—	—	—	—	—	—	—	26·1	26·4	107	101	65	67	46	46	65	67	47	46	9·1	1,929	1,918	3,847	67,531	17·58	E
F	All Links Full Gear	Nil.	5	76·0	76·7	130	68	68	67	18	2	67	21	1	—	—	—	—	—	—	—	—	26·2	26·7	91	90	73	67	46	46	73	67	47	46	8·3	1,931	1,936	3,867	68,514	17·72	F

glasses and drained into the main condensers by screw-down valves.

The cylinders are arranged high and intermediate forward, and the two low pressures aft. The two forward cranks being opposite one another, the two after cranks are also opposite one another, but at right angles to the two forward cranks. On all the trials there was an entire absence of vibration of the ship.

The high and intermediate cylinders are fitted with piston, and the low pressures with double-ported flat slide valves; these are actuated by the ordinary link motion. The reversing gear is of the "all round" type usual in naval engines, and provision is made for adjusting the position of each link independently.

There are a feed and a hot-well tank in each engine-room wing, these are fitted with connecting pipes to the corresponding tanks on the other side of the ship.

Steam is supplied by thirty Belleville boilers of the economiser type. They are arranged in four groups, back to back, and are stoked in the fore and aft direction. Transverse bulkheads divide the boiler space into four separate compartments.

The total heating surface provided is 47,300 sq. ft., consisting of 28,300 sq. ft. in the generator portion and 19,000 sq. ft. in the economiser portion, as against a total of 40,550 sq. ft. in the *Diadem*, viz., 29,600 sq. ft. in generator and 10,950 sq. ft. in the economiser portions respectively. It will be noted the proportion of economiser to generator heating surface is much larger than in the *Diadem*, but the proportion in the latter was due to her boilers having been altered to economiser type while in course of construction. The exact proportion, however, is not definitely settled, and so far as experiments have gone at present, the ratio of these two surfaces may vary considerably without affecting economy, as long as practically the same total heating surface is maintained. The grate area is 1,390 sq. ft.

There are two main condensers with a total cooling surface of 19,000 sq. ft. Each is provided with circulating water by two independent centrifugal pumps, 45 in. in diameter, placed in its own engine-room. Bilge suctions are fitted to these four circulating pumps, and each is capable of discharging 1,200 tons of water per hour from the bilge. There is in each engine-room a hot-well pump for taking water which has been delivered by the main or auxiliary air pumps to the hot-well tank, and discharging it through a filter to the feed tank; an evaporating and distilling plant, the two being capable of making 90 tons of water per day when worked non-compound, and 56 tons when worked compound, for the boilers, or 32 tons per day for drinking purposes, and the usual auxiliary condenser for condensing the exhaust steam from the auxiliary engines; this condenser furnishes a cooling surface of 1,100 sq. ft., and has its own circulating and air pumps.

Besides these, a steering, a ventilating, an electric light, and two fire and bilge engines are placed in each engine-room; a third electric light engine being situated in another compartment.

Each of the stokeholds has its furnace air-pumping and ventilating fan; and each boiler-room a main and an auxiliary feed engine.

Outside the machinery space there are engines for air-compressing, boat, coal, and ash hoisting, capstan working, refrigerating, &c.

The *Argonaut's* trials took place in the English Channel, the trial at 13,500 I.H.P. taking place on November 29th and 30th, 1898, that at full power on December 3rd, and at 3,600 I.H.P. on the 12th of that month. The displacement of the vessel on all the trials was about 11,070 tons, and speeds of 21·14, 19·94, and 13·16 were observed over a measured course of 23 knots for the full, continuous steaming, and 3,600 I.H.P. trial respectively.

A table is appended showing the average weights of machinery and heating surfaces of the boilers of the ships of the *Diadem* class, and of two ships of the *Argonaut* class, which have made their steam trials.

In comparing the figures, it will be seen that there is a decrease of grate surface in the *Argonaut*. This is due to the fact that the proportion of heating surface was increased in the economiser; the corresponding reduction of generator surface (the number of stages in the element remaining the same) leading to a decreased number of elements, and consequently of firegrate in proportion to the power.

As to the efficiency of these arrangements, it will be seen that the consumptions of coal in the case of the *Argonaut* class are slightly smaller than in the *Diadem* class; while, due to the substitution of economiser for generator heating surface, and to the increase of the number of revolutions in the engines, there is a decrease in weight per I.H.P. of about 9 per cent.

The water-measuring appliances were arranged primarily to ascertain the quantity of steam used for the main engines under various conditions as regards jacketing of cylinders, steam pressure, and rates of expansion. Opportunity was also taken to make certain observations as to the amount of steam used by the auxiliary engines; but this was not the principal object in view, and the various alterations of pipes necessary to enable an accurate separation to be made between the steam used by the auxiliary engines necessary for the propelling engines and the other auxiliary engines of the ship were not made.

The arrangements adopted may be briefly described as follows:—First, in order to measure the total water passing through the main and auxiliary condensers, the hot-well pump discharges were disconnected from the grease extractors and connected in each case to a pair of measuring tanks placed on the upper deck, as shown in the diagram. These were alternately filled and emptied, the water, when measured, flowing by gravity through the grease extractors into the feed tanks. Each of the four tanks was of 240 cub. ft. capacity, which gave about five-minute intervals between the times of switching from one tank to another when running at full power. It was arranged that the only steam or water entering the main condenser, except that from the separator, which was measured and allowed for, was that from the main engines and their jacket drains, so that the economy or otherwise of the various methods of working the main engines could be exactly ascertained.

To measure the water passing through the auxiliary condenser, the auxiliary air pump discharges were disconnected from

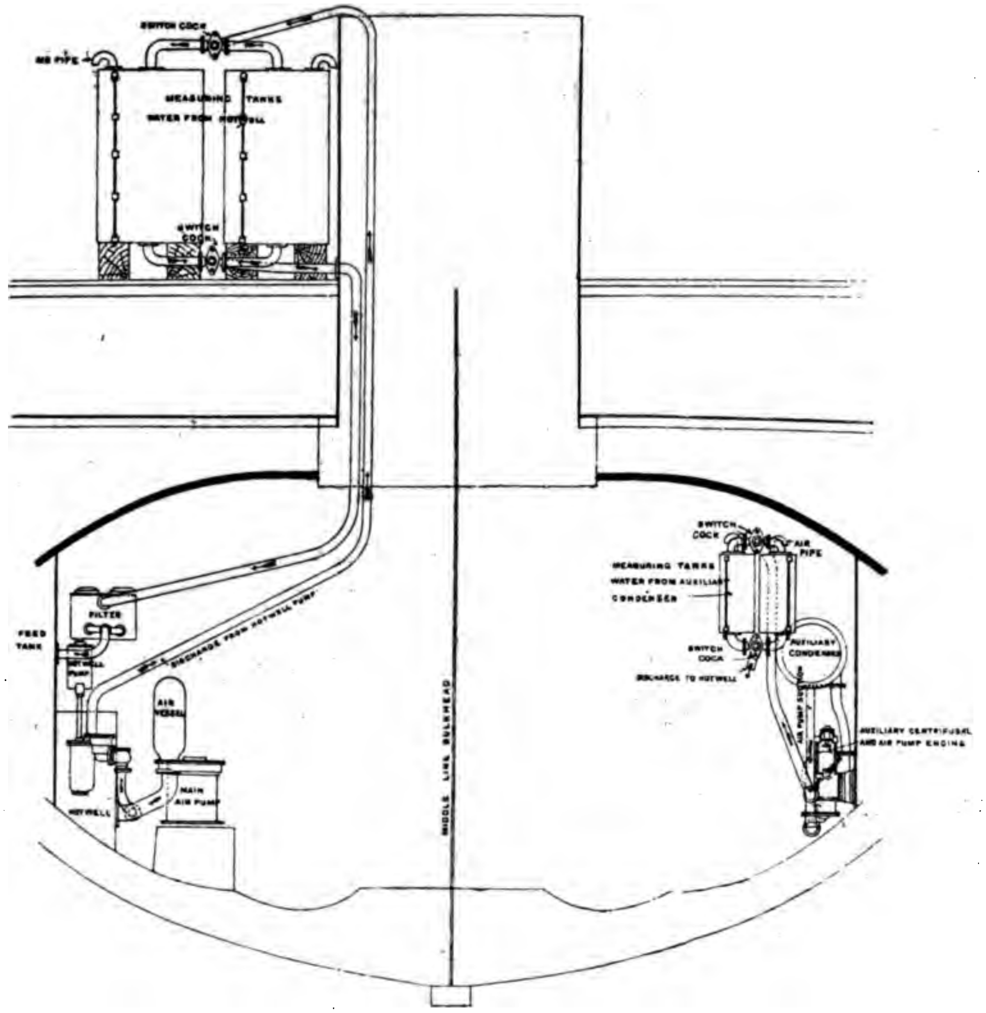
Class	Description of Trial.	Trial.									Weights.	
		Duration (Hours).	Revolutions.	Piston Speed	Steam Pressure.		I.H.P. developed (Mean).	Air Pressure.	Coal per I.H.P. per Hour.	Machinery Complete.	Boilers Complete
					Boilers.	Engines.					
Diadem ..	3,300 I.H.P.	30	67·9	543·8	218·5	160·5	3,339	—	2·04	1,540	767
	12,500 I.H.P.	30	106·5	852·0	267·0	230·0	12,785	—	1·71		
	Full Power	8	116·6	933·2	286·5	236·7	16,961	—	1·73		
Argonaut ..	3,600 I.H.P.	30	73·1	584·8	238·0	138·0	3,784	—	2·03	1,578	787
	13,500 I.H.P.	30	112·6	901·0	260·0	220·0	13,932	—	1·66		
	Full Power	8	123·6	989·0	291·0	257·5	19,025	·2	1·64		

Class.	Description of Trial.	Surfaces.		I.H.P. per ton (Mean I.H.P.)		Weight in lbs. per I.H.P. (Mean I.H.P.)			I.H.P. per square ft. of Grate (Mean I.H.P.)	Heating Surface per I.H.P. (Mean I.H.P.)
		Grate. Sq. ft.	Heating. Sq. ft.	Machinery Complete.	Boilers.	Engines	Boilers	Total.		
Diadem ..	3,300 I.H.P.	—	—	—	—	—	—	—	—	—
	12,500 I.H.P.	1,460	40,990	8·30	16·66	135	135	270	8·75	3·20
	Full Power.	1,460	40,990	11·01	22·11	103	101	204	11·60	2·41
Argonaut ..	3,600 I.H.P	—	—	—	—	—	—	—	—	—
	13,500 I.H.P.	1,390	47,300	8·89	17·70	127	127	254	10·02	3·39
	Full Power.	1,390	47,300	12·05	24·17	93	92	185	13·69	2·49

the grease extractors and arranged to discharge to small measuring tanks of about 30 cub. ft. capacity. As in the case of the large tanks, these were fitted in pairs; they were placed on the upper engine-room platform, and the water was run from them to the hot-well pump suctions, its quantity being thus included in the amount measured by the large tanks on the upper deck. The difference in the quantities of water measured by the small and the large tanks thus gave (subject to the allowance named above) the water used by the main engines and jackets. The diagram shows in principle the arrangement of tanks and connections employed, unnecessary detail being eliminated for the sake of clearness. Identical arrangements were made for measuring both the total and auxiliary water from each engine-room.

H.M.S. "ARGONAUT."

WATER MEASURING APPARATUS.


SWITCH COCK
AIR PIPE
MEASURING TANKS
WATER FROM HOTWELL
SWITCH COCK
FEED TANK
FILTER
HOTWELL PUMP
DISCHARGE FROM HOTWELL PUMP
AIR VESSEL
HOTWELL
MAIN AIR PUMP
MIDDLE LINE BULKHEAD
SWITCH COCK
AIR PIPE
MEASURING TANKS
WATER FROM AUXILIARY CONDENSER
AUXILIARY CONDENSER
SWITCH COCK
DISCHARGE TO HOTWELL
AIR PUMP SUCTION
AUXILIARY CENTRIFUGAL AND AIR PUMP ENGINE

THE ABOVE SKETCH INDICATES THE GENERAL ARRANGEMENT, BUT FOR CLEARNESS, THE EXACT POSITIONS HAVE BEEN SLIGHTLY ALTERED.

The slide valve settings in full gear, as actually measured, give the following cut-offs in the respective cylinders:—High pressure 73 per cent.; intermediate pressure, 67 per cent.; and low pressure, about 46 per cent. of the stroke. The cut-offs used during the trials are given in the tables.

It should be observed here that, as arranged for convenience of comparison in the tables, the order is that of the total ratios of expansion. The alphabetical order of the reference letters *gives the actual sequence of the trials*. The general scope and *results of the tests made are shown in the tables*.

Referring to Table I., which deals with the 8 hours' full-power trial, the main linking gear was run out to "full gear," and the high-pressure independent gear was used as found necessary to maintain the required power. The steam pressure at the engines varied from 236 lbs. to 244 lbs., and that at the boilers from 290 lbs. to 299 lbs. The real ratio of expansion was 8·5 throughout the trial.

The trial was started with the jackets out of use. After three hours the low-pressure jackets were filled with steam of about 20 lbs. pressure above that in the receiver, and remained in use for the remainder of the trial.[*] For the last two hours, the other jackets were also brought into use, the pressure maintained in the intermediate being about 20 lbs. above that in the receiver: but that maintained in the high-pressure jacket was not so high as its receiver pressure, it being apprehended by the contractors that the cylinder walls might become too dry for efficient working at the high piston speed required for maximum power.

Turning to Table II., which deals with the trial at 13,500 I.H.P., or the maximum continuous steaming power, it will be observed that the conditions of initial pressure and ratio of expansion varied considerably throughout the trials. The thirty hours was divided into six periods of four and one-half hours each, and one of three hours' duration.

---

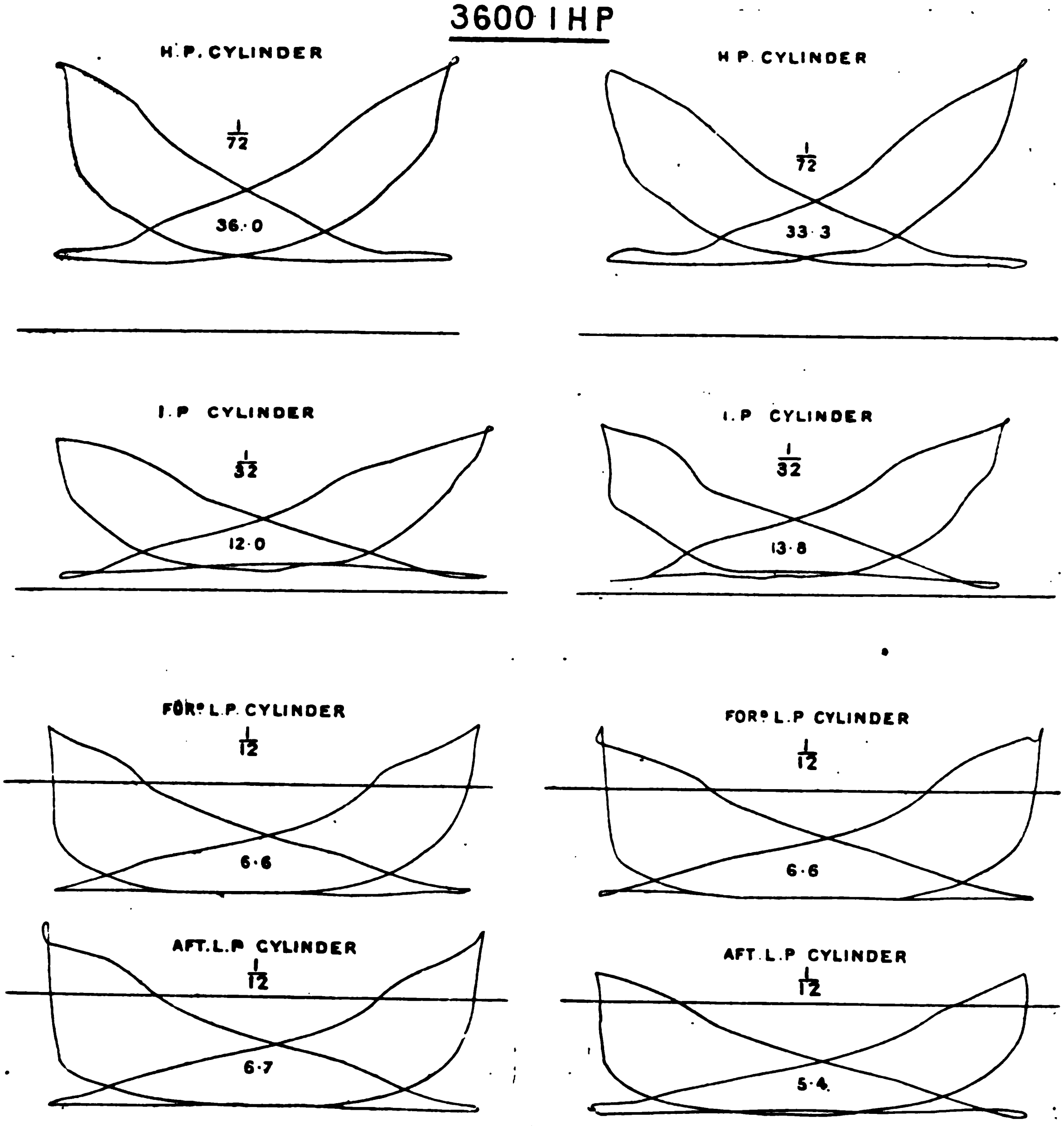
[*] In dealing with the tables and the following description it should be borne in mind that the engines are jacketed on the cylinder barrels only.

In trials G, C, D, the main and high-pressure independent linking gears were used to regulate the power. In trial G, with 12·5 expansions, all the jackets were in use, the pressure of the receiver being maintained in the high-pressure jackets, and pressures above those in their corresponding receivers in the intermediate and low-pressure jackets. In trial C, with 10·4 expansions, the intermediate and low-pressure jackets were used, the pressure maintained in them being in excess of their received pressure; while in trial D, with the same ratio of expansion, all the jackets were shut off. The steam pressure at the engines during these three trials varied from 229 to 248 lbs., and the boiler pressure from 251 to 280 lbs.

In trial F the main linking gear only was used to regulate the power obtained, the slide valves of all the cylinders being thus linked up. In this case 9·7 expansions were given, and the steam at engines and boilers was respectively 235 and 275 lbs. No jacketing was used on the cylinders.

In trial B, with 9·1 expansions, the main links were run out to full gear, the high-pressure independent link being used to obtain the cut-off; in this case steam of 287 lbs. was used at the boilers, and 190 lbs. at the engines, and, as before, no jacketing was used.

In trials A and E, again, the jackets were out of use, all the slide valves were in full gear, and the total expansion was 8·3


3600 I H P
H.P. CYLINDER
1/72
36·0
H P CYLINDER
1/72
33·3
I.P CYLINDER
1/32
12·0
I.P CYLINDER
1/32
13·8
FORD L.P CYLINDER
1/12
6·6
FORD L.P CYLINDER
1/12
6·6
AFT.L.P CYLINDER
1/12
6·7
AFT L.P CYLINDER
1/12
5·4

STARBOARD ENGINE.

H.P.	Recr.	167 lbs.
	Vac.	25·5 ins.
	Revs.	74·6
I.H.P.	H.	590
	I.	525
	F.L.	383
	A.L.	389
Total I.H.P.		1,887

PORT ENGINE.

H.P.	Recr.	170 lbs.
	Vac.	26·2 ins.
	Revs.	75·4
I.H.P.	H.	552
	I.	610
	F.L.	388
	A.L.	317
Total I.H.P.		1,867

times. In trial A the steam pressure at boilers was 194 lbs., and in trial E 282 lbs., the pressures shown at the engines being about 170 and 180 lbs. respectively, the difference between these two trials being that in one case the boiler steam was of higher pressure and reduced more by throttling than in the other.

In Table III. it will be seen that the thirty hours' trial at 3,600 I.H.P. was divided into six equal periods, each of five hours' duration.

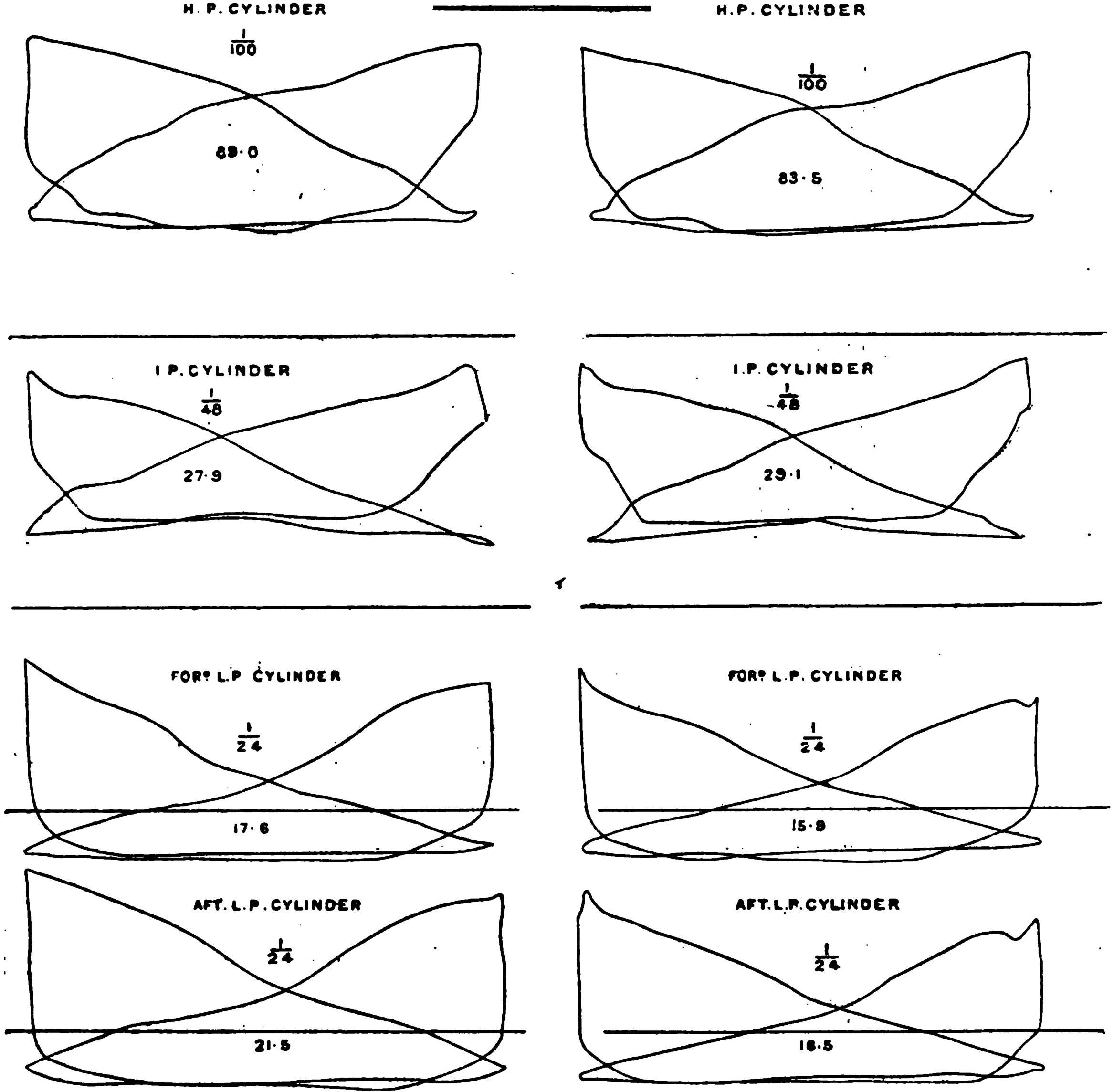
In trials A, B, and C, the main and high pressure independent linking gears were set to obtain the required power, the total expansion being 15·7 and the steam pressure at engines being about 168 lbs., and averaging 285 lbs. at the boilers. In trial A the high-pressure jacket carried nearly the same steam as the receiver; the intermediate and low-pressure jackets being maintained at about 20 lbs. above theirs. In trial B the high-pressure jacket was not in use, the steam pressure in the other jackets being maintained as in A. In trial C, as in the succeeding trials, D, E, F, the jacketing was entirely shut off.

In trial D the main links only were used to obtain an expansion of 13·2, the steam at the engines being 142 lbs., with a boiler pressure 280 lbs.

In trial E the main linking gear was in full gear, the high-pressure independent gear only being used to obtain the cut-off. 9·1 expansions were given to the steam; the pressure at the engines being about 78 lbs., and at boilers 285 lbs., this was reduced by throttling.

In trial F, all the links were placed in full gear, and with a total expansion of 8·3, 68 lbs. was the pressure used at engines.

13.500 I.H.P.



STARBOARD ENGINE.

H.P.	Recr.	242 lbs.
	Vac.	27 ins.
	Recs.	115 7
I.H.P.	H-	2,266
	I.	1,900
	F.L-	1,595
	A.L.	1,950
Total	*I.H.P.*	7,711

PORT ENGINE.

H.Y.	Recr.	240 lbs.
	Vac.	27·0 ins.
	Revs.	114·9
I.H.P.	H.	2,100
	I.	1,970
	F.L.	1,432
	A.L.	1,480
Total	I.H.P.	6,982

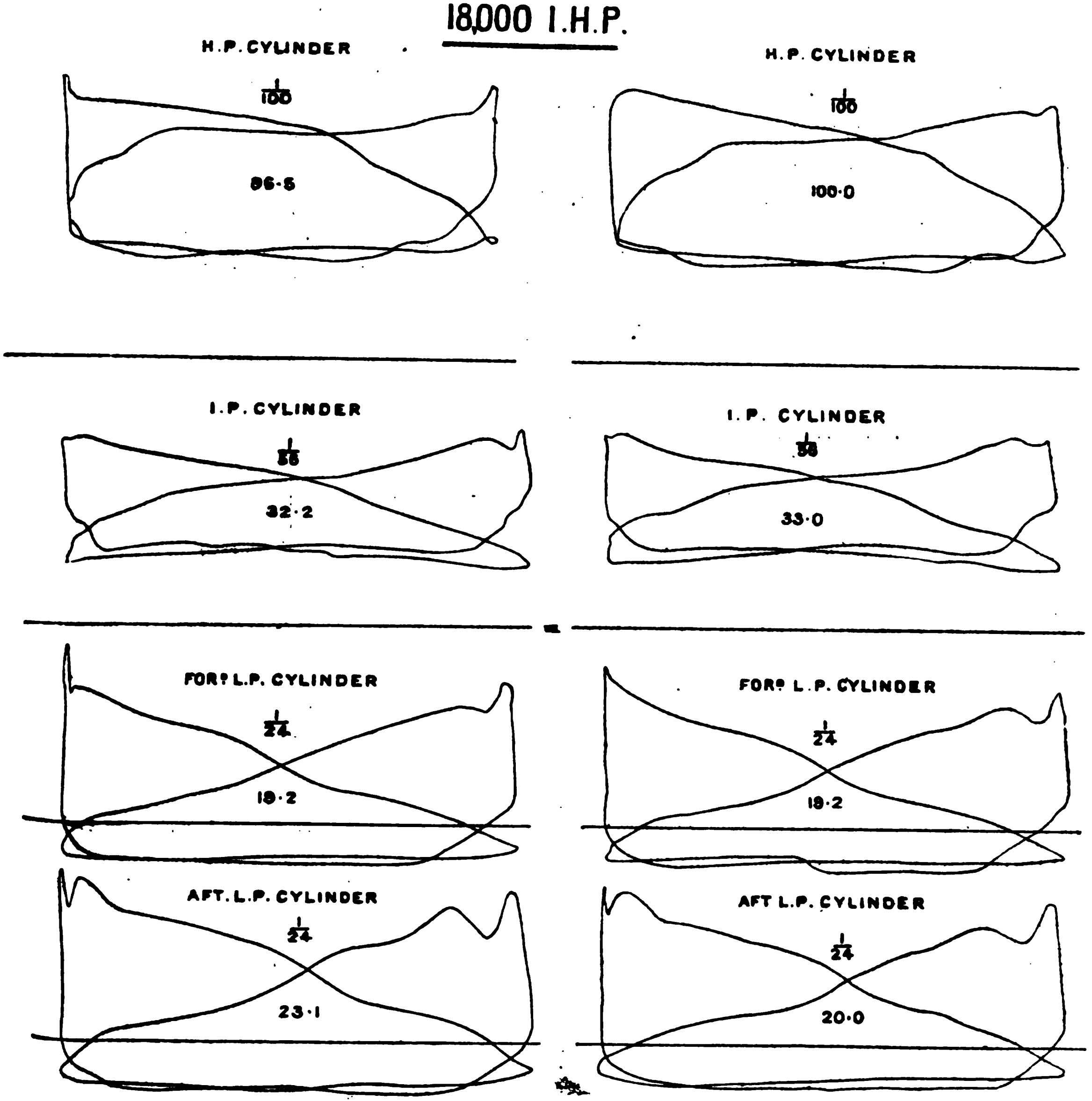
and 130 lbs. at boilers to obtain the power. No lower boiler pressure than this being practicable on account of the working of the electric light and steering engines.

Now to examine the effect of jacketing, as shown in these trials.

It will be seen by referring to Table I. that the engines were, with the exception of the alteration in the use of the jackets, under the same conditions in trials C, B, and A; and that the steam consumption varied from 16·64 lbs. per I.H.P. per hour when all the jackets were in use to 15·75 when all were shut off, it being intermediate, or 16·15 lbs., when the low pressure jacket only was in use. Thus, the consumption due to main engines and jackets was reduced ·89 lbs. per I.H.P. per hour, or 5·3 per cent., in changing from condition C to condition A, and ·49 lb. per I.H.P. per hour, or 2·9 per cent., from C to B.

In table II. trials G, C, D were under similar general conditions, as in Table I., as regards the use of jacketing, except that the high pressure jacket only was shut off in trial C. Trials C and D were carried out at an expansion of 10·4; trial G, which was at the end of the 30 hours' contractors' trial, was made at 12·5 expansions. Hence, although G shows a slight advantage to the jackets, compared with C, yet to compare the results of this trial with those on Table I. we will take C and D only. Here also there is a reduction of water consumption with jackets out of use, of ·43 lb. per I.H.P. per hour, or 2·7 per cent. between C and D.

In Table III., trials A, B, and C are under the same general conditions of steam pressure and expansion, and only differ as regards the use of the jackets. Here again, although in a very slight degree, there is a reduction of water consumption when



STARBOARD ENGINE.

H.P. Recr.		235 lbs.
Vac.		26 ins.
Revs.		127·4
I.H.P.	H.	2,704
	I.	2,406
	F.L.	1,908
	A.L.	2,295
Total I.H.P.		*9,313*

PORT ENGINE.

H.P. Recr.		233 lbs.
Vac.		25·2 ins.
Revs.		126·6
I.H.P.	H.	2,785
	I.	2,450
	F.L.	1,896
	A.L.	1,976
Total I.H.P.		9,107

the jackets are shut off, viz., ·06 to ·08 lb. of water per I.H.P. per hour, or rather less than ½ per cent.

Bringing these results together, the trials show approximately an increase of water consumption per I.H.P. per hour through the use of jackets as applied therein of—

·9 lb., or 5·3 per cent., at 18,000 I.H.P.;
·4 lb., or 2·6 per cent., at 13,500 I.H.P.; and
·06 lb., or less than ½ per cent., at 3,600 I.H.P.

The points of difference in these trials, which would affect the relative efficiency of the use of steam jackets, are the revolutions and expansions, and it appears that with the comparatively low revolutions and high expansion used at 3,600 I.H.P., the influence of the jacketing on the efficiency of the steam practically balances the expenditure of heat in the jackets, and that at lower speeds and powers, such as obtain at the cruising speeds of a fleet, a gain would probably be shown by the use of the steam jacket. At the higher powers the tests appear to show that no gain in economy is obtained by steam jacketing as carried out in this vessel.

Next considering the effect of the links.

On the full-power series the setting was not altered, and, therefore, had no effect on the consumption.

In Table II. trials D, F, B, E, and A were carried out without the use of the steam jacket, and the results may be exhibited as follows:—

	D.	F.	B.	E.	A.
Expansions	10·4	9·7	9·1	8·3	8·3
Lbs. of Water per I.H.P. per hour	15·44	15·36	15·97	16·22	15·73

It will be noticed that trials A and E took place at the same ratio of expansion, the difference being in the boiler pressures maintained.

In table III. the expansions vary from 15·7 in trial C to 8·3 in trial F, no jackets being in use in any of these trials. The consumptions are shown in the following table:—

	C.	D.	E.	F.
Expansions	15·7	13·2	9·1	8·3
Lbs. of Water per I.H.P. per hour	16·26	16·68	17·58	17·72

And it will be seen that corresponding to a decrease in the expansion from 15·7 to 8·3 there is an increase of about 9 per cent. in the consumption.

The consumption of water for all auxiliary engines in use throughout the machinery department and the ship during the hours in which the evaporators were not in use was, relatively to the power of the main engines:—

3·57 lbs. per I.H.P., or about 22 per cent. of the consumption of main engines only on the trial at 3,600 I.H.P.

1·59 lb. per I.H.P., or about 10·4 per cent. of the consumption of main engines only on the trial at 13,500 I.H.P.

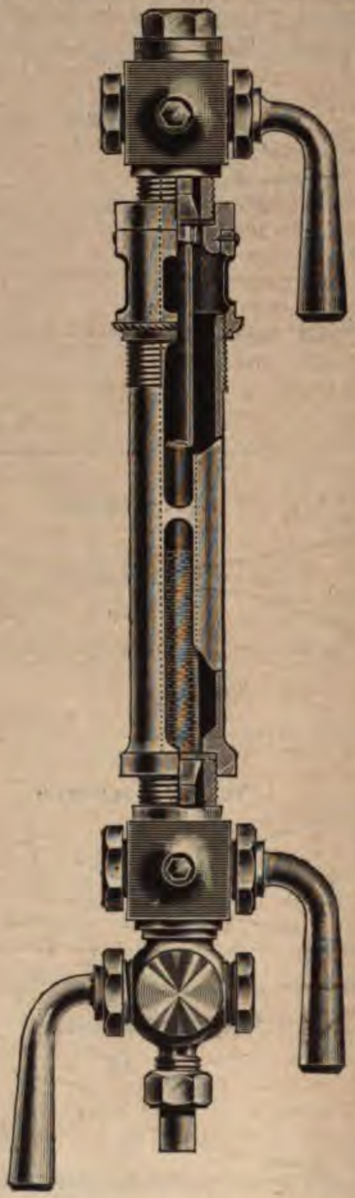
During the full-power trial the evaporators were in continuous use, and the amount of water passing through the auxiliary condenser was 44,651 lbs. per hour. As the evaporators were worked compound, and the secondary steam was led through a distiller, the drainage water from the second evaporator, as well as the boiler steam used in the first evaporator, was included in this quantity. The amount of water made by the distillers was measured by tanks. Allowance being made on the basis of the results of separate experiments made on evaporators and distillers, by the same maker, it is estimated that the consumption of steam for all auxiliary engines (excluding evaporators) was 1·88 lb. per I.H.P. per hour, or about 11·9 per cent. of the consumption of the main engines only. This increase in consumption for auxiliaries over that at 13,500 I.H.P. was, no doubt, due to the fact that, while the auxiliary engines which had been used on the 13,500 I.H.P. trial were generally working at higher speeds corresponding to the higher power of the main engines, double the number of furnace air-blowing engines were in use, working at a considerably higher speed, besides eight fan engines, running at 150 revolutions per minute, which were in use on this trial only.

Specimens of the indicator diagrams are given, those selected being for the trial showing the smallest water consumption of the main engines in each table.

Marine Engineers' Examination.—At the quarterly examination of Extra First-class Engineers, held in April, Liverpool has come to the front this time again, and Messrs. Walter E. Pride, David Gibson, and William Moffat were successful. The three candidates were students of Pritchard's Marine Engineering Academy, 8, Walton Road, Liverpool.

VILE'S PATENT WATER GAUGE.

THE breaking of water gauge glasses is of very frequent occurrence, and in these days of high pressure the consequences are often of such a nature as to clearly prove that the risks of injury from such cause are very great. The variation in length of the glass due to the expansion and contraction set up by the changes of temperature to which it is subject under working conditions, such as when, for instance, the glass is blown through for the purposes of cleaning it and ascertaining that the communication with the boiler at the top and bottom is intact and in proper working, is no doubt one of the most fertile causes of the fracture. For instance, if the packing or other jointing means at the top and bottom mountings hold the glass tube so tightly as to prevent it sliding therein when the glass expands, a compressive stress is set up, which tends to buckle or bend it, thus



readily producing fracture; or, on the other hand, when the temperature of the glass falls it contracts and sets up a tensile stress, which also increases the liability to fracture.

Many ingenious and elaborate devices have been devised in the past to overcome these difficulties, but we know of no device so simple as that which we now have the pleasure of placing before our readers, and which has obtained a very good name after nearly two years' use on a large number of steamers.

It may be said that it is essentially designed to effect the joint between the gauge glass and the mountings, so that, under no circumstances of variable internal pressure upon the mountings and glass, shall there be direct end or high lateral pressure upon the glass; and further that, by a metallic extension piece surrounding the gauge glass in direct metallic continuity with the mountings a high and more uniform temperature shall be maintained in the immediate vicinity of the external surface of the glass. Another important feature is that the invention is readily applicable to existent fittings.

By reference to the illustration it will be seen that the mountings are of the usual construction, the ordinary screw gland nuts having been removed from the screwed noses of the top and bottom fittings.

The glass is supported in each mounting by a cupped or hat washer of suitable elastic material, which will stand the high pressure steam such as "Woodite." The cylindrical part of the washer is brought to a knife edge, so that the steam pressure will itself make a sliding steam or water-tight joint upon the gauge glass. The flanged portion bears against the ends of the screwed noses.

The washers are maintained in place by the pressure set up by the slotted extension piece provided at the upper end with a short screwed portion engaging upon the same, so that the length of the extension piece can be increased and decreased by the screwing on or off of this short piece. When the steam-tight joint is made by pressure, having the tendency to thrust apart the fittings, it will be noticed that no strain whatever comes upon the gauge glass itself, but it is practically supported in a floating condition, totally uninfluenced by any alteration in alignment of the axes of the top and bottom mountings. The extension piece merely engages over the noses of the mountings loosely, so as to be guided thereby. When the internal pressure is relieved in the act of blowing down a gauge glass, it is obvious that there would be a tendency for the mountings, which have been kept apart by internal pressure, to close sharply together, and thus the risk would be run of fracturing the glass. In the device under notice this effect is entirely obviated, as the extension piece prevents any such action. The slots in the parts of the extension piece are provided to enable the gauge glass to be seen whatever the position of the extension piece.

There is another good feature worthy of note, viz., that it is found that the high pressure or temperature, or both combined, produce a change in the molecular structure of the glass, and it is often necessary to change the glass before it actually breaks. This particular method of mounting lends itself very readily to such an operation, which can be effected in a very few minutes without any difficulty or danger attached thereto.

We have had the opportunity of inspecting copies of a large number of testimonials relating to the invention as to results in actual use, and in every case the device receives the highest praise as to its efficiency and simplicity.

The inventor and manufacturer of this device is Mr. A. Vile, of 5, Denton Road, Cardiff, who is a chief engineer of many years' experience, and knows the difficulties that have existed hitherto, and therefore is, in a very good position to find an easy solution to the problem.

THE FLEETS OF THE MAIL LINES.

(*From our own Correspondent.*)

The "Angerton."

AMONGST the wrecks of the month of March was that of the Newcastle steamship *Angerton*, a vessel of some 2,600 tons, and of fifteen years of age. She was formerly of the Milburn Line. In 1885 she was in a somewhat serious casualty, stranding on the coast of Portugal and sustaining very severe damage. On that occasion she was, however, floated, the salvors getting the handsome contract of £200 certain, and if successful—as they were—a lump sum of six thousand pounds in respect of their work for the hull, and a further fifty per cent. in respect of the cargo. Her recent loss, however, was complete, her hull and cargo being disposed of for little over three hundred pounds. On her final trip she was bound from a South Wales port to Alexandria with a cargo of fuel, and stranded on the Egyptian coast about fifteen miles west of Alexandria. It should be noted that at the inquiry held at Alexandria a few days ago the conduct of her chief engineer, Mr. J. J. Chandlish, was commended, though other of her officers were less fortunate.

The "Tarifa."

Few of my readers are aware probably that the old Cunard *Tarifa*, whose departure to the yard of an Italian shipbreaker I chronicled some little time ago, held an Atlantic record. I only learnt the fact myself within the last few days. Yet a fact it is. And it is a record which is twenty-nine years old and still unbroken. It was not a speed record, of course. The poor old hooker was not built that way. It was barometric. On the 5th February, 1870, the *Tarifa* saw the barometer down to 27·3 in., a lower reading than any which had been recorded before or has been since that time, though the Nederland American liner *Spaarndam* saw it very fairly low at 27·57 in. in February of the present year. I have looked the voyage in question up in my notes, and I find that the *Tarifa* left Liverpool on the 1st February, 1870, and sailed from Queenstown at 4.15 p.m. the following day. She was bound for Boston, where she arrived at midnight on the 15th, having made the passage in thirteen days and a half, which was by no means a bad run for her, considering that the crack Cunarder *Java*, which sailed for New York three days ahead of her, was thirteen days on the passage whilst the Inman Steamer, *City of Baltimore*, two days behind her, was only just under thirteen days in crossing. This latter vessel then held the record for a day's steaming. The fact that the *Tarifa* did not make a particularly bad passage on this occasion is especially noticeable when it is remembered that eleven and twelve days seems to have been the old ship's usual time.

The S. Lawrence Trade.

Arrangements in view of the opening of the S. Lawrence have been made some little time now. The Allan Line has arranged to run the Shaw, Savill & Albion steamship *Tainiu* for the summer season in place of the lost *Castillian*. The *Tainiu* had a great name in her original trade, and held the record both ways on the long sea route. But she was too expensive in her running for the altered conditions of her original trade, and it is some time since she has been on the station. Under a very elaborate Spanish name she served the Spanish before the war in taking troops out to Cuba. She will doubtless prove comfortable enough for the Canadians, but her speed of but fourteen knots can hardly be considered excessive for the North

Atlantic in the present year of grace. The company has also taken over the old *Gallia*, formerly a Cunarder and recently running for the Beaver Line Associated Steamers.

Some little time ago I mentioned that Messrs. Elder, Dempster & Co. had bought the goodwill of the Beaver Line and the surviving "Lake" boats from the liquidators of the Canada Shipping Company. The Messrs. MacIver, who had been acting as agents for the Beaver Line since its reconstruction, contended that the right to the name was vested in them. They had certainly done what they could to infuse new vigour into the concern, having acquired the Cunard *Gallia*, which I have just referred to, and the New Zealand *Tongariro* to supplement the exertions of the older vessels. The position between the two firms has now resolved itself into this. There is the Beaver Line (Elder, Dempster & Co.), which is intending to maintain a service with fine and large new twin-screw cargo boats, and which made its inaugural sailing to the S. Lawrence with the steamship *Monterey* on the 27th April. There is also another and rival line managed by the Messrs. MacIver. It calls itself (as it has a perfect right to do) the "Beaver Line Associated Steamers, Limited. It can do this for the reason that when Messrs. MacIver took the management of the Lake boats and acquired the *Gallia*, they formed a separate limited company under that style to purchase supplementary vessels. Thus, though the main name has been taken away from them, the subsidiary title remains. There are thus two lines in the place of one, and it would appear that the struggle between them will be keen enough; for Messrs. MacIver are reinforcing their fleet with another New Zealand boat. This is the *Ruapeha*, larger and more modern than the *Tongariro*. The *Ruapehu's* latest claim to distinction was her feat in towing out the great floating dock, built for the Spanish Government by Messrs. C. S. Swan & Hunter, of Newcastle, from the Tyne to Havannah.

Meanwhile, as I have already remarked here, the Dominion Line, whilst maintaining its hold on the S. Lawrence, is making a serious and successful attack on the British passenger trade, of which by this time it has acquried a practical monopoly.

The "Stella."

The awful disaster to a London & South-Western Railway steamer bound to the Channel Islands, with a holiday crowd, cast a gloom over the Easter of 1899, though, at the same time, there was a melancholy satisfaction in the account of the behaviour of the crew of the vessel, who miminised by their coolness and discipline the loss of life, and in that of the passengers who retained their presence of mind and their self-control under circumstances of peril to which they must have been total strangers. It would have been well if the cheap and nasty Press, the experts—so self-styled—and advertising members of Parliament could have shown something of the same quality of self-effacement and have evinced a little respect for the characters of those who were no longer able to reply in their defence, and shown some sympathy for the surviving relatives of men who died at their posts. Some of the comments which have been made upon mere hearsay evidence have been little short of scandalous. It will be quite time to speak of the disaster, and its causes and lessons, when the result of the enquiry ordered by the Board of Trade is made known.

I may, however, say something of the vessel herself. She was the last launched of the three sisters which, in 1890, the railway company had launched from the Clydebank yard of Messrs. J. & G. Thomson as a reply to the new Channel fleet of the Great Western Railway. They were fitted with twin screws and triple-expansion engines, the most carefully designed accommodation that long experience could suggest, a high rate of speed, sufficient size to make them comfortable sea boats—they were nearly 1,100 tons gross register—and soon made themselves popular. Appliances for safety were not forgotten, the vessels being divided into eight water-tight compartments. I notice that the *Stella* was unlucky at her launch, which was attempted on the 15th September, 1890. When nearing the water she unexpectedly stopped and the efforts of those in charge of the arrangements failed to move her. She was, however, safely floated on the following tide and sustained no injury by the occurrence. I only mention it because some of those who are connected with the sea still have their superstitions about the luck of launches, and they may be interested to note such facts.

The "Gaspesia."

On the night of the 16th April the unlucky *Gaspesia* arrived at last at the port of Trepassey, Newfoundland, being assisted thither by the steamer *Kite*. It appears, according to the reports which have been flying about, that an offer to salve the old P.S.N. boat had previously been refused by her master. One can hardly wonder at it if the terms of the would-be salvor were correctly quoted. He "only" asked the sum of 100,000 dols. This would be a good deal more than the vessel herself would be worth in her sound condition. For it is the exact sum at which Messrs. C. W. Kellock & Co. placed the sound value of the Cunard steamship *Pavonia* in the recent salvage suit. The *Pavonia* is nine years younger and 1,700 tons greater than this vessel. Still, the little *Kite*—she is a wooden screw sealer of but 280 tons gross, belonging to Messrs. C. T. Bowring & Company—has done very well for herself, her owners, and crew, even though she has performed the task without any agreement.

The damage to the *Gaspesia* seems heavy. Her rudder was reported as fractured very early in her term of imprisonment, and since she has got into port, it has been stated that she has both frames and beams broken by the pressure of the ice. So she must go into graving dock on the other side, and it will be some time before Milford sees her again.

The *Werra* and *Fulda* are still reported as lying in the docks at Birkenhead, and no announcement, up to the time of writing, has appeared as to the resumption of the ice-free service from Milford.

Speaking of

Messrs. Kellock's,

I may mention that this firm has now opened a London office at 59, Cornhill, E.C., in addition to its well-known offices in Liverpool, where it has been established for upwards of three-quarters of a century.

A Result of the Recent Heavy Losses in Missing Steamers

is seen in the recent order by the Committee of Lloyd's to the effect that any broker found dealing with a clerk (on private account) will be expelled from the institution. The rule is one which has long been in force on the Stock Exchange with salutary effect. Probably it has not been found necessary to adopt it at Lloyd's hitherto. It is practically only in the overdue market that outsiders can gamble. Speculation in this department seems heartless and indecent, for it is making bets on matters which closely touch the lives of hard-working men and the happiness of helpless women and children. Yet it is obvious that it would be neither possible nor just to forbid altogether insurance of this kind of risk. Many persons have very large and legitimate pecuniary interests, which they need to at least partly cover when a vessel is at sea for an unusual period without being reported and it would not be right to forbid their doing so. But anything which tends to check gambling pure and simple in this department is, in the cause of decency, to be very much welcomed.

A Change of Name.

The old Guion liner *Arizona*, once the holder of the "blue ribbon of the Atlantic," went out to work in the new Trans-Pacific service of the Northern Pacific Railroad Company—as may be within the recollection of my readers—after being re-engined and boilered by her builders, the Fairfield Company. The United States Government having acquired her as a trooper, she is now called *Hancock*, in memory of one of the generals of the United States army in the War of Secession.

The Cunard Company's Meeting

was held last month. I do not propose now to go into their accounts or to review their position. That is inviting enough for a candid critic, but it cannot be dealt with here. But at the meeting Lord Inverclyde, the chairman, took occasion to inform his shareholders that the retaining fee in respect of the steamers *Lucania* and *Campania* would—according to notice received from the Admiralty—be withdrawn in September. This was a very disquieting piece of news indeed, as it fell from his lips. We see how the Germans and the French are building vessels suitable for commerce-destroying in time of war, or for fast transport service when the exigencies of the times may require it. We have nothing but the *Oceanic* of this class, even under contemplation. The vessels of the American Line have just proved under the actual test of service conditions how invaluable this class of vessel really is as an auxiliary to naval operations. Any real discouragement to patriotic shipowners would have been most disastrous to the country. But the naval estimates show that no reduction in the amount to be expended in these retaining fees is contemplated, and the matter was at best the discovery of a mare's nest on the part of his lordship.

The fact is that the Admiralty have merely given the notice, to which Lord Inverclyde alluded, with a view to a possible revision of terms, and with the object of getting, if possible, a better return to the country for the money it annually expends in this direction. No one can find anything but approval for such a course of action.

The French Atlantic Trade.

The Compagnie Générale Transatlantique is making further extensions of its service. A new cargo line from Havre to New York, with a call at Paulliac, is under contemplation. The pigeon post too—for what it may be worth—is being pressed forward, and experiments in this direction are made with every west-bound steamer of the mail line. In order to encourage the emigrant traffic from Italy, special trains, originating at Modane, on the Italian frontier, are run in connection with every mail steamer from Havre. But serious opposition is threatened to the company. The vessels of the American Line—commencing with the westward trip of the steamer *New York* in April—now call at Cherbourg on both the eastward and westward trips. The Hamburg American Line calls at Cherbourg with its express steamers, and is also starting a new intermediate service with big twin-screw passenger and cargo boats from Hamburg and the Thames, calling at Boulogne-sur-Mer, whilst the Nord-Deutscher Lloyd continues to put in at Cherbourg with its express steamers on its way to and from Southampton.

The West Indian and Pacific Steamship Company

continues its good luck (or good management) of 1898. One of its 8,000-ton twin-screw boats, the *American*, has been chartered to the National Line to help the new steamer *Manhattan*, of the same size, to maintain the London and New York service. The sister-ship *European* has just towed the broken-down steamer *Silverdale*, of Newcastle (owned by Messrs. Milburn), into Bermuda, and will, no doubt, thereby make a good salvage, as the *Silverdale* had broken her shaft and was entirely disabled when the *European* came along. The new boats of the same company, named respectively *Antillean* and *Colombian*, are also under charter, being employed in work between Galveston and Hamburg for the Hamburg American Company's service.

American Steamship Enterprise.

The assumption of the responsibilities of colonial empire have caused the Americans to launch out into shipowning, and consequently into steamship building. So the American-Hawaiian Steam Navigation Company has been incorporated with a capital of £150,000 sterling. Its headquarters will be in New Jersey, and it intends to trade through the Straits of Magellan from New York to San Francisco, and thence to Hawaii. Its operations may be extended to Alaska, America's more northern possession on the mainland. Its first order for two twin-screw cargo-boats of a length of upwards of 400 ft., and of a tonnage of about 8,500 each, has been placed with the Union Iron Works of San Francisco. These vessels are to be ready for work by April of next year. Another similar pair have been ordered from the Roche Shipbuilding Company, of Chester, Pennsylvania. Economy of coal consumption is—as is practically a necessity when the character of the voyage for which they are designed is considered—one of their essential characteristics. The New York and Cuba Mail Company, for which last year Messrs. Cramp, of Philadelphia, built a fine new steamship named the *Havana*, have had a twin-screw mail boat of nearly 6,000 tons launched by the same famous builders. She will be named the *Mexico*, and will have all the latest improvements which characterise modern ships of the highest class. The same builders have contracted with the Oceanic Steamship Company to construct three other twin-screw liners of a guaranteed speed of 17 knots, to ply between San Francisco and Australasian ports. The vessels in question will be of about 6,000 tons gross register, and will, in addition to their coal and passenger capacity have room for about 2,000 tons each of cargo. There is a rumour, however, that, owing to reasons connected with the non-passing of the United States Shipbuilding Subsidy Bill during the recent session of Congress, the work upon these vessels will not at present be pressed forward.

The American Line

has during recent months made its service but a fortnightly one. One of its vessels, the *Paris*, made a trip from New York round the new West Indian possessions of the United States with a party of tourists, and opportunity was taken, whilst ther of its vessels were dry-docked, to fit bilge keels, which will eventually be added to the whole of the fleet, so as to insure steadiness at sea. All the vessels are now at work again, and the regular weekly service is resumed, with one of the fleet advertised as an extra boat once every three weeks, on Wednesdays. The *New York*, leaving Southampton on the 25th March, called at Cherbourg, and her example in this direction will be followed, so that French passengers will be enabled to travel by the American Line without having to cross to Southampton. Arrangements are made whereby week-end trips to the other side of the Channel can be made by those who are fond of comfortable sea trips, facilities being given for the return of such passengers to Southampton by the London & South Western Railway Company's vessels. The only drawback to such trips will be that the time which the traveller can spend on the ocean liner will be all too short.

The White Star Line.

The *Afric* after her maiden trip was sent across to Belfast, where her builders are engaged in increasing her passenger accommodation. The *Germanic* is still at Belfast, having a thorough overhaul, and it will be some weeks yet ere she will resume her place in the mail line. Meanwhile her place is being filled by the *Cymric*, whose only fault seems to be that she has not accommodation for a sufficiency of passengers.

Work on the *Oceanic* is progressing well, and about mid-summer she should be ready to leave her builders' hands. To her has been appointed as chief engineer, Mr. Thomas Wilson Sewell, who is the commodore engineer of the line. This gentleman has had charge of the machinery of all the vessels now running regularly with the mails for these owners, and has previously been in the first *Oceanic* and in the *Baltic*. He has crossed the Atlantic no less than five hundred and twenty-eight times as chief engineer in the White Star Line. His previous experience had been in the service of Messrs. Lamport & Holt. In the new ship he will have a staff of twenty-one engineers under him, the total engineering staff amounting to no less than 182 men, as against 160 in the *Teutonic* and *Majestic*.

The Pavonia

has returned to her work, making her first departure from Liverpool since her accident on the 11th of April. Appreciation of what those in charge of her did in the fulfilment of their duty during her most trying experience has been shown, though perhaps our authorities were more tardy and less gushing than the Germans showed themselves in regard to the officers and crew of the *Bulgaria*. The Cunard Company distributed the sum of five hundred pounds amongst the officers and crew of the vessel. The silver medal of Lloyd's was awarded to Captain Atkin and to Mr. Duncan, the chief engineer, by the Committee. These, and other marks of appreciation, were presented to the officers, at a public meeting held in the Town Hall at Liverpool, by the Lord Mayor (the Right. Hon. William Oulton), who made a very sensible, and not too adulatory, address upon the occasion. The Board of Trade has been approached with a view to inducing the department to grant some recognition to these officers. But the suggestion was not accepted, the Marine Department responding with the declaration that it was not their custom to take any notice of the behaviour, save, of course, in the way of censure, of their certificated officers in regard to the ships with which they were entrusted. This answer is perhaps open to the retort that the sooner this precedent is departed from, the better it will be alike for the Board of Trade, the country generally, and the certificated officers.

No inquiry has been held into the accident to this ship. Yet she must certainly be admitted to have sustained such "serious damage" as would have warranted the Board in ordering one had it been disposed to do so. A very useful purpose might have been served if it had been held, as it would have been very instructive to see whether the mode of securing the boilers in position was that usually adopted, and whether improvements in the method cannot be introduced without serious difficulty.

Within the last few days another vessel, *La Serena*, has been towed into an Australian port in the same condition as regards her boilers. In this case, however, the vessel had been in contact with rocks, and her bottom had been set up to a considerable extent. No blame could therefore under these circumstances have possibly been attached to the mode in which the displaced boilers were secured.

The Milwaukee,

of the Elder Dempster Fleet has become a ship again. Her stranding on the East Coast of Scotland last year, and the heroic remedy adopted for her salvage, will not have been forgotten. Messrs. C. S. Swan & Hunter, who were her builders in the first instance, had the salved portion of the hull returned to them. They placed it on their pontoon dock and built a new fore body to the vessel. This work having been completed, the vessel was launched,for the second time in her short life of under two and a half years, on the 12th April, and she will shortly resume her duty in the fleet, having been re-classed at Lloyd's, and being now as good as she was when she first came out.

Some interesting facts appear in the

Annual Report of the Norddeutscher Lloyd.

The company is prosperous enough—the dividend recommended being at the rate of seven per cent. But with this matter we are not interested, save in so far as we may take it as an indication that German competition with British shipping is not likely to become anything save more keen in the future. The building of big steamers, however—of course on the twin-screw principle—seems bound to go on here. The old *Spree* is coming out shortly as a practically new twin-screw express steamer steamer under the name of the *Kaiserin Maria Theresa.* She will apparently have nothing to connect her with her former self except a short length of her fore body. Why any one should have thought it worth while to sacrifice a good vessel for that passes understanding; but there it is. Two vessels of the size and type of the *Barbarossa* are building for the China service. They are to be called the *Konig Albert* and the *Prinzess Irene.* Two steamers of similar size are building for the Atlantic cargo service, and another larger vessel to be called the *Grosser Kurfurst* is constructing for the New York express service. This latter service will therefore be maintained by the *Kaiser Wilhelm der Grosse*, the present record holder, the *Kaiser Frederich*, which not having come up to the builder's guarantee is not yet accepted, the rejuvenated *Kaiserin Maria Theresa* and the *Grosser Kurfurst*, One might almost suggest to the Germans that it would be wise to make it penal to give vessels names which are three and four barrelled. For it seems as though awful confusion would be certain to arise between the *Kaiser Wilhelm der Grosse* and the *Kaiser Wilhelm II.* and between the *Frederich der Grosse* and the *Kaiser Frederich*, whilst the length of the names now in the fashion with the company contrasts most unfavourably for practical purposes with such names as *were formerly* adopted, such as *Elbe*, *Spree*, *Eider* and *Lahn*. *These latter too being geographical* and patriotic, had much to recommend them to all classes of the German community. There are again three twin screw steamers of 7,500 tons each named the *Kolr*, *Frankfurt* and *Hannover* building for the Baltimore service. As to their nomenclature there is no fault whatever to be found. Only one of all the ships named in building is in a British yard. Messrs. Wigham, Richardson & Co., of Newcastle, have had the good fortune to secure an order for a large twin screw cargo boat; but it is simply through the inability of the German yards to undertake all the work which the great shipping companies of the Fatherland hrust upon them.

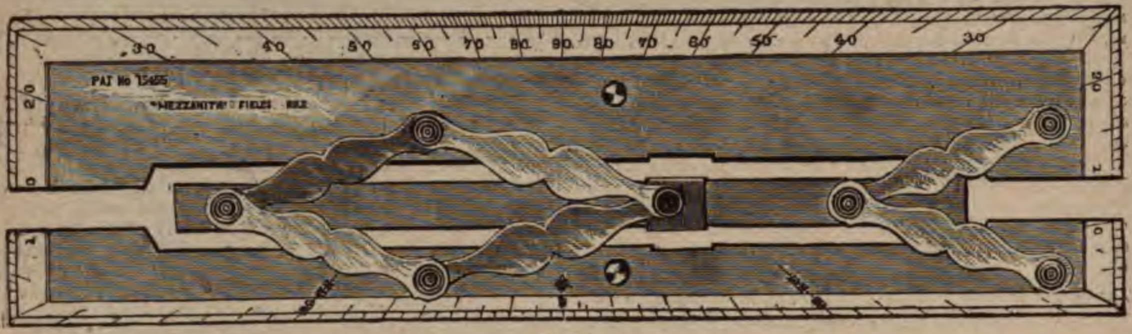


Fig. 1.

THE "HEZZANITH" PARALLEL RULE.

THE objectionable feature which obtains with the ordinary parallel rule consisting of two straight parts or rules, jointed to one another by two connecting rods of equal length pivoted to the rules and parallel to one another is well known, viz., that the progression of the rule over a surface can only be effected in a diagonal line and in one direction only; hence, when the rule is used over a wide range normal to the edge of the rule, a very large margin of room must be available in the direction of the ruling edge in order to use the rule effectively. This feature is entirely due to the construction of the parallel motion of the rule.

Now, navigators and others who have to carry forward parallel lines over large surfaces, such as on charts, will, we feel sure, thoroughly appreciate the benefits to be derived from an instrument which will effect this object in a line normal to the line they desire to carry forward.

We have pleasure in bringing to the notice of our readers a very ingenious, simple, and effective device which is adapted to carry out the above object. In the adjoining diagrams Fig. 1 represents one form of the rule; it will be seen that the two parts of the rule are pivotally jointed by four connecting rods of equal length to an intermediate element, and that the three elements are maintained in a parallel position to one

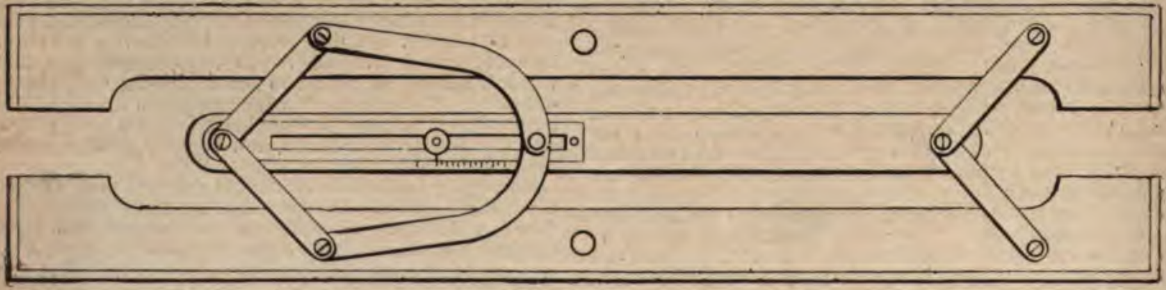


Fig. 2.

another by a sliding sleeve engaged upon the central element, the sleeve being pivotally connected to the two parts of the rule by two connecting rods of equal length.

Now, it will be readily seen that, when the two parts of the rule are moved relatively to one another, the parts are always parallel, and the motion is normal to the edge of the rule.

In Fig. 2 we illustrate a modification of the device in which the sliding sleeve is superseded by the pivot of the middle connecting rods engaging in a slot situated in the central element. The side of the slot is graduated, and an adjustable stop is engaged therein, so that the relative movement of the two parts of the rule can be regulated to a predetermined and definite amount. By this means lines of exactly the same length, and immediately over each other, can be drawn; and, further, the distance between the lines can be regulated at a fixed uniform distance by the adjustable stop.

We feel sure that this useful little instrument only requires to be known in order that its merits shall be widely appreciated by its extensive use.

The manufacturers are the well-known firm of nautical-instrument makers—Messrs. Heath & Co., Limited, of London and Crayford.

BUENOS AYRES HARBOUR WORKS.

At the ordinary meeting of the Institution of Civil Engineers, on Tuesday, the 18th April, Mr. W. H. Preece, C.B., F.R.S., President, in the chair, the paper read was on "Buenos Ayres Harbour Works," by Mr. J. M. Dobson, M.Inst.C.E.

As early as 1862 the late Mr. Eduardo Madero, of Buenos Ayres, had turned his attention to the question of docks for the port of that city, but all applications to Congress for permission to construct a system of docks failed until the year 1882, when an Act was obtained under which the executive Government were authorised to contract with Mr. Madero for the construction of docks and warehouses, together with entrance channels. The docks were to be constructed on the riverside of Buenos Ayres, between the gas works on the north and the Riachuelo river on the south.

On the recommendation of Messrs. Baring Bros, Mr. Madero applied to the late Sir John Hawkshaw, Past-Pres. Inst. C.E., to undertake the engineering, and his firm reported in March, 1884. The report was subsequently approved, and the appointment of Sir John Hawkshaw, Son and Hayter confirmed. A contract for the general work was let to the late Mr. Thomas Andrew Walker; a similar engagement being also made with Messrs. Sir W. G. Armstrong, Mitchell & Co., for the whole of the hydraulic machinery.

In the preparation of the plans, two points had to be carefully studied, viz., the exact position of the docks and the direction of the entrance channel. It was ultimately decided to place the docks parallel to the coast and to provide locks at both ends. With regard to the direction of the channel it was decided to turn it as quickly as possible into the run of the river in order to avoid excessive silting.

The works comprised: A south basin with a water area of 35 acres, and a depth of 21 ft. 3 in. below low water. Four docks connected with each other by passages, crossed by swing-bridges, having a lock at the south end 65 ft. 6 in. wide and 442 ft. 9 in. long, with a depth over sills of 21 ft. 9 in. at low water, and at the north end a lock 82 ft. wide and 508 ft. 4 in. long, with a depth over sills of 22 ft. below low water. The two locks were each crossed by a swing-bridge, and the depth of water in the docks was 23 ft. 9 in. below low water. A north basin, having a water area of 41 acres, with a depth of 21 ft. 3 in. below low water. On the east side of this basin was the entrance to the north channel, which was 100 metres wide at the bottom with slopes 10 to 1. It had been dredged to its intersection with the south channel, a distance of 9·8 kilometres. On the north side of the basin were two graving-docks equipped with all necessary pumping machinery: one dock 600 ft., the other 492 ft. long, each having a depth of 20 ft. over the sill at low water. The total water area of the four docks and two basins was 174 acres, and the length of quays 27,821 lineal feet. Thirteen warehouses had been built on the west side of the docks, having a total capacity of 641,715 cubic yards, and a floor area of 202,751 square yards (41·89 acres). Eight sheds (one bonded) had been constructed, having a total capacity of 122,040 cubic yards, and a floor area of 27,870 square yards (5·76 acres).

The whole of the foregoing works were enclosed by an outer wall nearly three miles long, of which 7,793 lineal feet were of stone construction, the remaining portion being of timber. There were railway lines on both sides of the docks connected with the north and south trunk lines of the Republic.

The docks, passages and lock-walls were all built of rubble masonry of granite, the coping, bedstones, quoins, steps and machinery foundations being of ashlar masonry of granite. In one month alone 17,488 cubic yards of rubble masonry were built, requiring some 26,700 tons of stone from the contractors' quarries.

In order to carry out the works, banks had to be formed to enclose the different sections. At the south end of the south basin, owing to depth of water and the tide, crib-work was constructed so that side-tips could be used, thus depositing the material more rapidly to form the bank. As each dock was completed a timber dam was erected in front of the passage which connected the completed dock with one to be constructed.

The pile-engines used in the construction of the outer wall were the first constructed of their kind. They were really steam hammers, but instead of the hammer-head moving and the cylinders remaining stationary, the hammer-head was fixed and the cylinder struck the blow.

From the entrance of the north basin to Ko. 2·3 the dredging of the north channel was in tosca, with a layer of sand at the top. From Ko. 2·3 to Ko. 4 it was in mud intermixed with sand, and from Ko. 4 to the end the dredging was in mud. The mud and sand were brought and pumped ashore, and the total area filled represented 294 acres. Great difficulty was experienced in landing the tosca dredged, amounting to 651,700 cubic metres.

The channel had six beacons in the length of Ko. 9·8. Buoys were moored every 1,000 metres apart. The channel was not yet completed to deep water. When the plans wereprepared it was intended that the Government, who were dredging the south channel, should complete a channel from the intersection to deep water by the time the north channel was finished to that point, but such had not been the case.

The whole of the bridges, gates, sluices, capstans, cranes, and lifts were worked by hydraulic power.

The graving-dock walls were built of rubble masonry of granite, with altars, copings, steps, &c., of ashlar masonry of granite. In the west dock (first commenced) the invert was built of bricks, but, as it was impossible to secure sufficient bricks to complete the second invert, concrete was substituted. The water was admitted to each dock by two sluices, one on either side of the dock, and with these two sluices the dock could be filled in about twenty minutes. The dock entrances were closed by ship caissons.

The pumping machinery consisted of two centrifugal pumps with vertical spindles, each driven by a balanced compound condensing horizontal steam-engine coupled direct to the pump spindle. The west dock was completed in 10 months from the date of the Act, and the east dock, together with the pumping station, in 15 months. The amount of work done during the 15 months was enormous—including 56,464 cubic metres of rubble masonry alone.

The total area of land reclaimed from the river was 926 acres, of which 561 acres had been made up more or less to quay level; and the total cost of the works was £6,997,360.

Marine Engineers' Examination.—At the recent examination for Extra First-class Engineers, Mr. W. H. Shephard and Mr. Archibald McK. Laird were two of the successful candidates. These gentlemen were students at Leask's Marine Academy, and both passed the first time of going up.

Aspinall Patent Marine Engine Governor. — We are informed that Messrs. David Joy, Son & Pryor, of 85, Gracechurch Street, London, have been appointed agents for the London and Southampton districts for the Aspinall Patent Marine Engine Governor.

FRIEDMANN'S SIGHT-FEED LUBRICATORS. NATHAN (PATENT.)

TO secure a regular, equal, and economical lubrication of the various moving parts in an engine, it is essential that sight-feed lubricators, with multiple independent feeds should be used. Friedmann's lubricators, of which over 50,000 have been sold, are from single to quadruple independent sightfeeding, contents from 1½ pint to 9 pints. Each sight-feed fitted with an auxiliary feed, which may be used in case a sight-feed glass should break, or also to increase the regular feed in case of emergency. The lubricators are entirely of gun-metal, fitted with all necessary cocks, valves, safety arrangements and condensor, etc., and represent a perfect auxiliary for modern engineers.

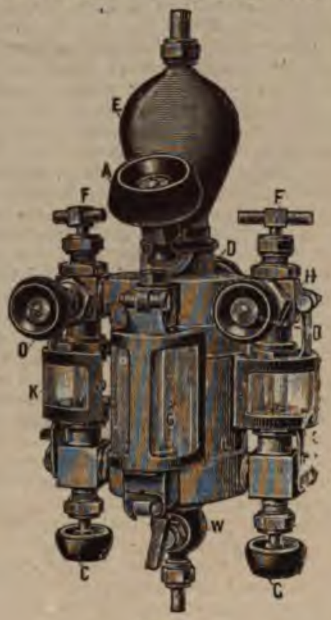


Fig. 1.

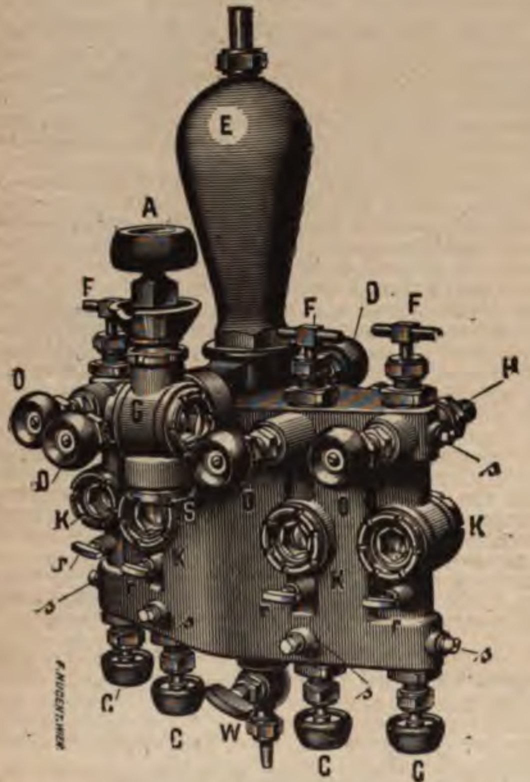


Fig. 2.

In the adjoining illustrations we show the latest types of two patterns of the Friedmann's Lubricators, put on the market by Messrs. Klinger & Co., 66, Fenchurch Street, London, E.C. It will be seen that Fig. 1 represents a double sight-feed lubricator with round glasses, while Fig. 2 shows a quadruple sight-feed lubricator with flat glasses. A is the filling plug, C the oil regulator valve, D the water valve, E the condenser, F the safety valves, G the gauge glass, H the oil pipes, K the sight-feed glasses, J the oil cup, O the auxiliary oilers for use if the sight-feed glass breaks, or to increase the regular feed, W the drain cock, V the valves to clear the sight-feed, and S S are the cleaning studs.

NAVAL ARCHITECTS.

DISCUSSION ON SIR JOHN A. DURSTON'S PAPER.

MR. THORNYCROFT said this was a most important paper, as it was the first occasion on which they had an account of the water consumption of the engines in the ships of Her Majesty's Navy. The paper dealt with the subject in a manner which ought to give them the greatest pleasure. It gave them also the particulars of the working of the engines during the experiment; and the water for auxiliary engines was so separated that they had the water used by the main engines and also that for the auxiliary machinery.

Mr. C. E. Stromeyer thought this was a most valuable paper, inasmuch as it gave them accounts of the large quantities of water used by the main engines and auxiliary machinery separately.

Mr. Seaton said there was very little controversial matter in the paper. He believed it was the custom of the Admiralty to test Belleville boilers on shore. But they seldom were given the evaporative power of the boilers, and if they could have that it would add much to their knowledge, for they could then separate the efficiency of the boiler from that of the engine. The paper showed that the lower the pressure of the steam the better the result. For high speed of piston steam jackets involved a loss, and he had been long of that opinion. They had now obtained from this paper accurate measurements of the water consumption as against the coal consumption per I.H.P.

Sir John A. Durston, in reply, said the water consumption of the auxiliary engines amounted to 3·57 lbs. per I.H.P., or 22 per cent. only of the consumption of the main engines on the trial at 3,600 I.H.P. That figure of 22 per cent. showed the importance of taking the consumption of the auxiliary engines, and they hoped as time went on they would show a better record for these than 22 per cent. of the main engines. The jacketing served the purpose of warming up the engines before getting under way. The air formed a non-conductor between the working barrel and the atmosphere of the engine-room.

Some Steam Trials of Danish Ships. By Captain A. Rasmussen, of the Engineering Department, Royal Danish Navy.

This was a paper on trials of vessels under different conditions. They were undertaken for the purpose of determining (1) the maximum speed, the full power speed, and the sea speed at normal draught and at a standard depth of water (6 fathoms for small vessels, 8 for larger ships); (2) speed trials for the determination of the curves of H.P. and revolutions at normal draught and at different depths of water; (3) speed trials for the determination of the above-named curves at the standard depth of water and at different displacements; (4) coal consumption trials for the determination of the most economical use of the propelling machinery with different numbers of boilers and engines in use; (5) trials for determining the time necessary for raising steam and getting under way; (6) determination of the power of the propeller to decrease and increase the speed of the vessel.

Sir Wm. H. White was sure the feeling of every member of that institution was one of gratitude to Captain Rasmussen for giving that paper, the preparation of which was entirely due to himself. Captain Rasmussen, about five years ago, gave in *Engineering* the results of similar trials. The Danes had a good reason for making these trials about their coasts. They had large stretches of shallow water. He thought the results were of more scientific interest than practical application. From the diagrams, it appeared that at speeds from 12 to 15 knots per hour the expenditure of power was extremely great in proportion to that at more reasonable depths. The trials to determine the influence of displacement on speed confirmed our modern practice.

Mr. Thornycroft was interested in the paper because the vessels referred to in it were built by his firm. He had always thought it dangerous to have windows in the boilers, but he was glad there had been no accident as yet.

Mr. Macfarlane Gray was interested in Fig. 1 of the paper, which was a diagram containing curves of slowing speeds. He had been searching for years for such information, and was glad he had found it. It had great importance in reference to collisions at sea. He would be glad to know in what space vessels could be stopped or reversed.

Sir E. J. Reed said he would like to know the character of the bottom of the vessels used in the trials.

Mr. Martell asked whether a vessel was influenced by the action of the earth at the bottom of the sea when it was travelling in shallow water. Water, they knew, pressed with equal force on a ship from any direction. Did the earth attract like the planets.

The Machinery of Warships—Twin v. *Triple Screws.* By Commodore George Melville, Engineer-in-chief of the United States Navy.

It was read by Lieut. Norton. He said, in the preparation of a set of tables, showing the force required to drive a vessel of a given displacement at a given speed, data had been used which were gathered from the results of about 200 trials of nearly as many ships. It was shown that the propulsive efficiency of vessels with three screws was in almost every case above that of ships approximately the same size, speed, and general lines, but fitted with only two sets of engines. The cruisers *Columbia* and *Mineapolis* had shown themselves superior in efficiency and speed to other vessels, in consequence, mainly, of having three propellers. Other factors were the greater safety of the machinery of the ship, due to the use of three screws. Smaller propellers were required for the same total power. Of full-power trials, from the economical standpoint, it was best to use a single screw. Beyond this point the use of twin screws would lead to a reduction of the power required for a given hull and maximum speed; and at any time where twin screws were good, triple screws were better. His estimate of the average economy of twin screws over single screws was about 8 per cent. for vessels of maximum speeds from 12 to 20 knots, and triple screws were more economical than twin screws by from 5 per cent. for 15-knot ships, to 12 per cent. for those of 24 knots speed. Taking a vessel of, say, 12,000 tons, 23,000 H.P., and 22 knots speed when all engines were used at full power—(1). The power required to drag one screw, uncoupled from the engine and left to revolve freely, was 150 H.P. at 10 knots, 600 H.P. at 15 knots. (2). If coupled to the engine at 10 knots speed, the power absorbed in dragging was slightly in excess of 300 H.P. (3). If two screws were dragged, the loss from drag was practically double what it would be with an idle screw for the same speed of ship. (4). The loss in power due to condensation in an engine was almost exactly one pound of steam in the cylinders for each H.P. of the maximum power for each engine. It applied to jacketed engines. (5). With three equal screws the entire propeller had not sufficient area to give economical results when used alone at speeds above 8 knots; and the use of the two wing propellers alone could be depended upon to give a considerable gain in economy for all speeds from 8 to 17 knots inclusive.

Mr. Seaton acknowledged the indebtedness of the institution to Commodore Melville, but thought that he had in emphasising to the utmost the advantages, and minimising to the utmost the disadvantages, of the triple-screw had proved too much. Forty years ago, during the time of the Crimean war, the triple screw was tried in a vessel in the British Navy. The trial was accidental, but it was resorted to for one of the reasons urged by Commodore Melville for the adoption of the triple screw. A single-screw floating battery built at that time developed such a very poor speed that something had to be done, and the authorities came to the conclusion that the fault was due to the smallness of the screw. As her draught did not permit her having a larger screw it was decided to put in two wing screws driven by gearing from the original main engines. Any improvement of speed obtained from the three screws would be completely eaten up by the friction of the wheel gearing.

Professor Miles did not attach much weight to the advocacy of the triple screw on transatlantic ships, on the ground of greater security in case of such an unusual circumstance as the complete break down of both engines.

Sir Wm. White said the paper contained very few facts, and they could not discuss the question of the relative merits of the triple and the twin screws on the basis of recorded facts. He knew more than he could at the moment say—exact information of the scientific character, not worthy of triple-screw steamship performances, but of the comparison of such performances with model experiments. He could say he knew of no facts to establish the contention that "the use of triple screws leads to a considerable economy at the highest speeds." Was it not a suggestive fact that after being introduced to arrangements (1) of triple screws of fairly equal size; (2) of a very small screw in the centre and two large screws at the side—a system which had been boldly tried in Russia—they were introduced to (3) a large screw in the centre and the two small screws at the side? But we must certainly look forward to higher speed; and we had to accept limitations of draught. Therefore if present propelling arrangements and present types of machinery were persisted in, and unless some more radical changes took place, the time might not be long before for certain classes of ships triple or multiple screws would become the rule.

Lieutenant Norton said he knew Commodore Melville had the authority of fact for the conclusions set forth in the paper, and, no doubt, he would before the transactions were printed be pleased to furnish the facts to the Council.

Stresses in a Ship's Structure. By Mr. J. Bruton.

He discussed the break in the continuity as represented by the end of a bridge. He shows the shearing strain of the hatch corner to be 3·09 times greater than the mean full strain across a section in way of the hatchway. He also discussed the late Professor Jenkins' views in which he stated the shearing stresses on the deck plating were very small indeed.

Mr. Martell said in dealing with vessels of general construction where continuity of strength was maintained throughout the length of the ship up to the gunwale, Lloyd's experienced no difficulty, such ships with the ordinary framing and building provided for could take care of themselves. Great difficulty was felt in meeting the problems arising out of new stresses brought to bear and the symptoms of weakness exhibited at the junctures were those erections were made. Another serious matter prominently brought forward in the paper was the continued extension in the size of hatchways in ships of the present time. Lloyd's were frequently urged to make allowance for steel or iron decks, but when looked into it was found that those decks were cut away by enormous hatchways, often two-thirds the breadth of the deck.

Professor Biles said the question of stresses had been a constant worry to believers in the girder theory. There were two methods of dealing with the question, one was by having no discontinuous points in the structure, the other method was to strengthen the discontinuous points sufficiently to resist extra stresses brought to bear on them. An attempt was now being made to make the bridge-deck long enough, and strong enough, to resist the main stresses of the ship, but he thought it was worth consideration to try to disconnect the bridge-deck horizontally from the main structure of the ship, rather than to attempt to make the points of discontinuity strong enough to resist the stresses that came upon them.

Discussion on Mr. Milton's Paper.

Sir John A. Durston said as far as the Admiralty was concerned, many of the points dealt with were insisted upon in the specifications. The latest requirement specified for in regard to the use of steam pipes was that pipes above 1½ in. diameter should be made in steel, and those below in copper solid drawn. Steel pipes up to, and including, 9 in. in diameter were to be solid drawn, while above that diameter they were preferred to be solid drawn; but might be welded with a butt strap over the weld.

Mr. Seaton said the best they could do with their old copper pipes was to take them out and put steel ones in their place. Mr. Martin, of Flushing, made his pipes as we should a hollow shaft, formed them out of the solid, and the cost was not greater than that of copper pipes. The fear that the steel pipe might corrode on the inside, had deterred a great many engineers from selling their copper pipes and substituting steel ones. After very many years' experience of wrought-iron, cast-iron, and steel pipes, he had found practically no damage of any kind on the inside.

Mr. List said the number of cases in which his firm had had to take out pipes a few days before sailing was quite remarkable. He had fitted copper pipes in straight lengths with expansion joints and bound these with copper wire. They had not caused the slightest trouble. The pipes used by his firm had cast-steel flanges screwed on in all cases, and no trouble from leakage had occurred in any of the flanges in the experience of four or five ships. It was found after three or four years' use that there was a brown deposit on the surface, probably a little oxide, but there was no corrosion. He did not think it was necessary to periodically take down copper pipes and anneal them. If the pipes were tested every four or five years by hydraulic pressure it would be sufficient. Wrought-iron pipes were a good deal cheaper than copper ones, but the stuffing-boxes and other arrangements brought up the expense.

Mr. Wingfield exhibited a piece of copper on which his foreman coppersmith had allowed two drops of tin, heated over a blow-pipe, to fall. One drop had gone right through the copper, leaving a hole, while the other had embedded itself in the copper. Tin was thus an undesirable alloy.

Mr. Milton said the question of soldering material had been gone into very thoroughly by Professor Arnold and himself. He had found on enquiry that half the manufacturers used half per cent. of tin. He found nearly all solder manufacturers kept close to 50 per cent. of copper and 50 per cent. of zinc. respectively. He had seen common brazing solder go right through a ⅜-in. pipe.

Portable Pneumatic Riveters,

by Mr. W. J. Badcock, was read by the Secretary, Mr. G. Holmes. He said, as Manager of the Chicago Shipbuilding Co., he had after experiments introduced machinery, capable of being operated by unskilled labour, by which all the rivets in a ship could be driven, which had been entirely successful and, in the last ship which was completed, 250,000 rivets were so driven out of a total of 340,000, and but for insufficient air supply the proportion would have been greater. They used a pneumatic hammer, consisting of a cylinder, in which a piston reciprocated, delivering almost a continuous series of blows against the end of the chisel, caulking tool, or rivet die. The hammer was light and powerful, short enough to go between frames, and small enough to get at rivets in corner angles.

The Strength of Boilers.

by Mr. C. E. Stromeyer, Chief Engineer of the Manchester Steam Users' Association. He said they did not yet know what the collapsing pressure of a furnace was. He gave the per centage of strength for a rivet seam to be

$$B = \frac{1{\cdot}26\ (l-d)\ \tfrac{3}{4}\ d\ \tfrac{1}{4}}{l}$$

He took cases of floors which collapsed under pressure, and examined their strength in the light of formulæ and found they were sometimes as much as 113 per cent. too strong, and in other cases 40 per cent. too weak. He discussed the plates for an oval-shaped furnace, slab plates, firebox, crown girders, tube plates for feed heaters. The paper had a long appendix giving the results of numerous tests.

Mr. Milton said the author stated, "In conclusion, I beg to say one word with regard to my use of Lloyd's formulæ for boilers. The engineering members of this Institution are more familiar with these rules than with any others, and naturally would compare them with any experiences which are laid before them, and Lloyd's Register will, I hope, be pleased at seeing their rules set up as a universal standard of comparison." Yet wherever else in the paper, Lloyd's rules were referred to, they appeared to be mentioned to show they were incorrect. He really must take exception to such a position. The experiments made by the Leeds Forge Company, and other firms, were not perhaps made with tubes "almost mathematically cylindrical," but they dealt with other matters as they were in ordinary furnaces, with the sole object of obtaining knowledge of the strength of the furnaces actually to be used. Dealing with the statement that "occasionally moral pressure on the part of shipowners and engineers, had resulted in a reduction of scantlings," Mr. Milton said he joined the staff of Lloyd's Register 24 years ago, and was cognisant of every reduction of scantlings which had been made. The initiative in these cases had usually been taken by officers of Lloyd's Register, while at the present time Lloyd's Register had the benefit of the advice—not the moral pressure—of a consultative body of engineers and shipowners, on whose experience the modification in the rules is based.

Mr. Stromeyer hoped that even the results of the experience which he had put before them, like the knowledge of other outside science, might be found useful by marine engineers. So far from wishing Lloyd's to alter their rules or do anything hasty in that direction, he maintained that his paper did not in any way advocate that they should be departed from. Everything at sea depended on insurance rates. Lloyd's had never had an explosion, and the insurance world looked to Lloyd's Register as a guide on the subject of the safety of ships and their machinery. The information given in the paper had been given for the purposes of comparison with Lloyd's Rules.

Sir Edward Reed said it was perfectly clear the paper had been written in absolutely good faith, and that the council had seen in it ample merit for its production.

Mr. Howden read a paper on "Torpedo Boat Destroyers for Sea Service," and Mr. James Hamilton "On the Communication forwarded by Messrs. J. Inglis and A. Denny and Professor Biles on the subject of Mr. James Hamilton's paper on the horse-power absorbed by Skin Friction and Wave Making."

Professor W. E. Dalby read a paper on "The Balancing of Engines, with Special Reference to Marine Work." He said it was to explain and illustrate a semigraphical method of treating balancing problems in a direct and simple manner. He showed how to obtain a simple formula for finding the best distribution of the mass of the connecting-rod between the revolving and reciprocating parts. He showed how to ascertain the resultants of the disturbing forces and couples for a system of masses revolving about a fixed axis, how the resultant force and resultant couple might be reduced to a Poinsot's central axis for purposes of comparison. The conditions of balance were stated in a geometrical form. He showed that the motion of a system of revolving masses in balance might be projected on a plane, and the projected simple harmonic motion would be in balance; and inversely assuming a system having simple harmonic motion, its balance might be investigated by translating the motion into a corresponding circular motion. He finally showed the balancing of a four-crank engine, neglecting the angle of the connecting-rod.

Professor Dunkerley said he would like to ask if the calculated masses were at all approximate to the actual masses, such as might be expected to be found, or whether there was considerable alteration necessary; and if the designers would, before the engine was in the ship, trouble to so arrange their masses as to guarantee in the absence of obliquity a perfect balance. To solve the problem only three masses were required. If they had four reciprocating masses given, the problem was indeterminable; they had got too much, and in ninety-nine cases out of a hundred there would be no exact solution.

Professor Greenhill said the subject was familiar by reason of the paper of Mr. Macfarlane Gray. He was sorry that gentleman was unable to be present. About 30 years ago it was thought a crank axle in a locomotive would very soon become a thing of the past. While it had never appeared in America, it was gaining ground in this country. The superiority of the crank axle consisted entirely in the diminution of the disturbing mass moments, as Professor Dalby's explanations and the experiments with the model had shown. Hitherto, it seemed as if attention in balancing had been devoted to bringing the centre of gravity into the line of the axle, so as to annul disturbing centrifugal force, ignoring as apparently intractable those transverse disturbing moments. He thought it would be worth while striking a compromise, leaving a certain amount of unbalanced centrifugal force in the axle of the locomotive engine, and with that latitude striving to diminish the products of inertia in mass moments.

Mr. Thornycroft said one felt after hearing the paper that they could balance an engine in five minutes. He could not quite agree that the difference of one-ninth of the maximum force of the moving masses was so small an item as not to be taken into consideration, and was rather afraid a disturbing force of that amount caused real trouble in a ship. The practice of his own firm to avoid the niggling of the ship by the turning moments had been to put the cylinders as near together as possible. If equal forces were put as nearly opposite as possible, the disturbing forces were to a large extent eliminated.

Sir William White, as one of those who had to do with building ships, said he should hope they were all agreed that it could not be good either for the engine or for the ship to allow the causes of vibration to remain any longer than they need be. From a naval architect's point of view, he regarded the placing of a badly balanced engine in a ship as nothing less than an outrage. To be compelled to adopt a largely increased strength of structure to stop a thing which never ought to begin was certainly a wrong way of working.

Professor Dalby said the introduction of properly balanced engines would, no doubt, largely increase the patronage of passenger ships, minimising, as they would, the discomforts of over-sea voyages.

THE X.L. ADJUSTABLE LATHE MANDREL.

WHEN turners wish to turn anv piece of metal concentric with a cylindrical bore of small dimensions they fix the metal on a solid cylindrical mandrel. This mandrel has a slight taper, and the piece to be turned is forced on to the mandrel. The adjustable mandrel we illustrate simplifies the fixing of such greatly, and entirely prevents any injury to the cylindrical surface to be held, and also possible injuries in the process of forcing on.

The mandrel consists of two parts only—a tapered screwed plug and a flexible round nut. This nut is cylindrical and flexible on the outside, and tapers like the screw. A larger eye can be fitted by using a parallel cylindrical flexible sleeve, slotted in the same manner as the nut and placed over it. The screw and nut are made of best steel, thoroughly case-hardened and practically unwearable. They are lighter than the solid mandrel, and are more easily fixed. Thin tubes or bushes may be turned on them without injury. They are being adopted in Messrs. Yarrow and Co.'s and many other engineering firms. They are made from one inch up to twelve inches diameter, and are sold by Messrs. John Turnbull, Junr., & Sons, of 39, Victoria Street, Westminster, London, and 18, Blythwood Square, Glasgow.

FRIEDMANN'S PATENT RESTARTING INJECTORS. 1899 PATTERN.

WE have the pleasure to place before our readers the latest patterns of the well-known Friedmann's Injectors, of which 160,000 are in use. Friedmann's injectors, 1899 pattern, are fitted with the latest and most modern improvements; every care has been taken to get an article scientifically as well as mechanically perfect. The main features for which these injectors have been designed are:—1st, that should the admission of steam or water be interrupted from any temporary cause, the injector will restart itself as soon as such cause of interruption has ceased; 2ndly, that the injector shall work steadily, and without the least loss through the overflow after the steam valve has been fully opened; 3rdly, no regulation required should the steam pressure and temperature of feed-water vary, thus reducing attention to a minimum; 4thly, simplicity in construction, involving great ease of cleaning; and, 5thly, that the quantity of water delivered shall increase with the boiler pressure. These injectors have no moving parts and will take very hot water. However, the greatest advantage of these injectors is the *enormous quantity of water* they deliver in contrast with all other injectors. Friedmann's injectors deliver at a return pressure of 200 lbs., a far larger quantity than at a steam pressure of 100 lbs. This feature cannot be over-estimated, as there is a clearly increasing tendency to raise the steam pressure. In the adjoining diagrams we illustrate in Fig. 1 a front elevation of the vertical combination injector; Fig. 2, a side elevation; and Fig. 3, a sectional front elevation of the same. Figs. 4 and 5 show similar views of another pattern.

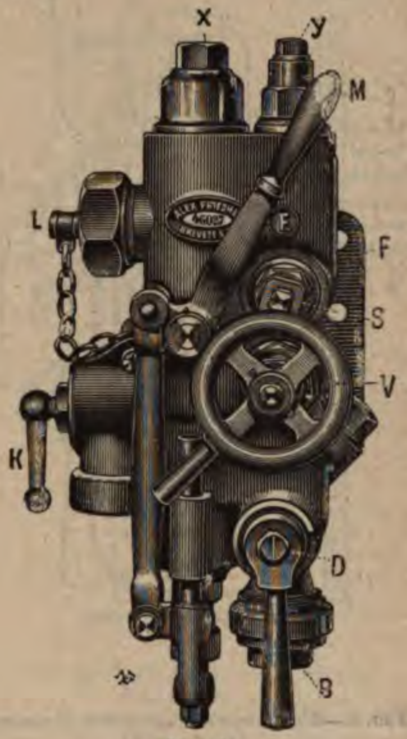


Fig. 1.

In these illustrations it will be seen that A is the steam inlet, B the water inlet, C the water delivery, D the water regulating valve, F the flange for mounting the injector, K the overflow valve, k the overflow pipe, M the starting lever, S the boiler check valve, Y the back pressure valve, X the cap for removing the covers, and L the union for fire hose connection.

We understand that the range of regulation in working is over 50 per cent.; the injector can therefore be worked continuously or intermediately.

These injectors are put on the market by Messrs. Klinger & Co., of 66, Fenchurch Street, London, E.C., who have just issued a new catalogue, illustrating and clearly describing the various specialities they sell. They include in this catalogue some extremely interesting facts with reference to the function of the various devices in comparison with others in the market.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

Contracts and Penalties.

AN old question has once again come to the fore, that is, the delivery of vessels by contractors long after the time specified by the Admiralty. In a letter to the *Morning Post* on this subject a correspondent points out that in the case of a destroyer which ought to have been completed four years ago, the penalties would have amounted to £23,000, if they had been enforced by the authorities at Whitehall. Other instances are given of destroyers which have been sadly behindhand in delivery, and the writer argues that the penalty clauses should be enforced. It would be folly, however, if it were not left entirely to the discretion of the Admiralty to settle whether this should be the case, for special circumstances often arise making it impossible for the contractors to complete the vessels in the stated time. The engineering dispute for instance, was responsible for a great deal of delay in the delivery of vessels, and if the Admiralty had enforced their rights at this time, the mischief caused by the strike would have been still further increased. The question, it will be remembered, was raised in Parliament some time ago, and, in reply, Mr. Goschen said that the Admiralty had no desire to penalise the contractors, or to fine them for having failed to complete contracts which could not, in the special circumstances, have been completed. But it is not right to put down all the delays to strikes, and, when it is no longer possible to advance this matter as an excuse for breach of contract, the contractors should not be allowed to escape so easily. It should be remembered that the penalty clause has at least one excellent effect, if it is not allowed to become a dead letter; it deters those from contracting at cutting prices who in the public interests are best kept out of the competition.

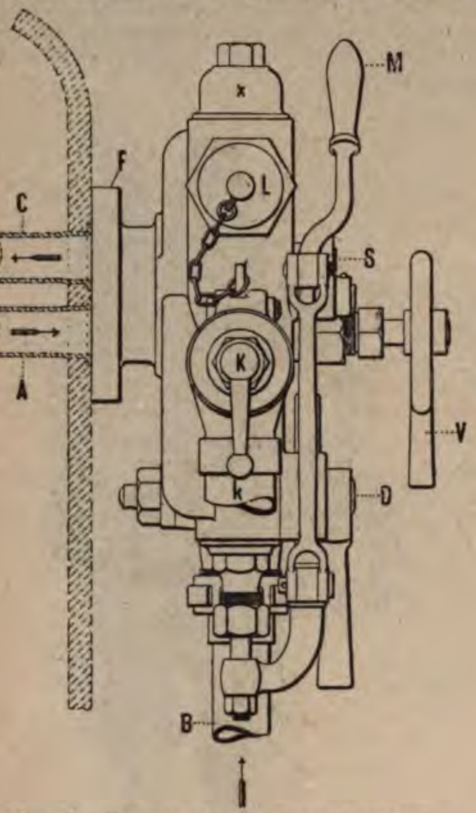


FIG. 2.—FRIEDMANN'S RESTARTING INJECTORS.
(*See page* 69.)

Portsmouth Dockyard.

There is little doubt that the *Terrible* will have to undergo a considerable overhaul before she is once again ready for sea. New boiler-tubes will have to be provided, for it is clear that all the welded-tubes will have to be taken out of her, and weldless tubes substituted. It is a pity the *Terrible* cannot be sent for a spell of foreign service, as this would probably do more towards getting her into proper working order than all the tinkering at the hands of the dockyard "maties." Her sister-ship, the *Powerful*, has just made a record run from Hong Kong to Manila without the least mishap, which speaks very highly for those in charge of her machinery department. It will not be long now before the *Andromeda* and *Gladiator* are ready for sea, and the steam trials of the *Canopus* will most probably take place in two or three months' time. As regards the other ship in hand, the *Pandora*, she is taking shape very rapidly, and also the *London*, but this battleship would get on much faster if more hands were employed upon her. Work on the *Formidable* is not progressing quite so rapidly, as the dockyard authorities have had to wait a long time for the Admiralty to decide on some minor details of her construction. The scheme of shore defence for Portsmouth, commenced here last year, is being continued, for it is now settled that about 20 or 30 12-pounder quick-firing guns are to be mounted on the shore at Stokes Bay. Portsdown Hill forts are to have the same number of guns mounted. The *Alexandra* is now in dock here undergoing her annual refit.

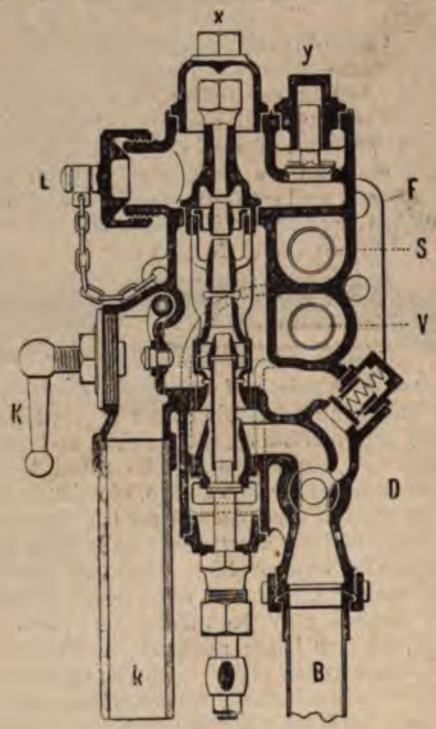


FIG. 3.—FRIEDMANN'S RESTARTING INJECTORS.
(*See page* 69.)

The Promise of the Estimates.

Turning to the other side of the question, it seems that a great deal of arrears of the work caused by the dispute in the engineering trade in 1897 is to be made up, for it is promised that five battleships, fourteen cruisers, seven unprotected vessels, and twenty-four torpedo-boat destroyers will be passed into the Fleet Reserve before the end of the financial year, 1899-1900. The battleships are the *Albion*, *Canopus*, *Glory*, *Goliath*, and *Ocean*, and the cruisers include the *Andromeda*, *Spartiate*, *Ariadne*, and *Amphitrite*; the *Gladiator*, *Hyacinth*, *Highflyer*, and *Hermes*; *Pandora*, *Pioneer*, *Pyramus*, *Perseus*, *Prometheus*, and *Pomone*. Of the unprotected vessels the most important is the Royal yacht, which is to be launched on the 9th of this month, and the other vessels are the sloops *Condor* and *Rosario*, the gunboats *Bramble*, *Britomart*, *Dwarf*, and *Thistle*. The trials of these vessels must certainly arouse considerable interest, for several of them represent new classes. Almost all are fitted with Belleville boilers, and five machinery makers are represented, Messrs. Maudslay, Lairds, Penn, Hawthorne, and the Greenock Foundry Co. During the year six ships are to be launched, and the same number of armoured ships commenced, in addition to three third-class cruisers and two sloops. This, it must be admitted, will be a good year's work, especially when compared with the previous financial year, in which only ten protected cruisers and twenty-one destroyers were added to the effective list. To man all the vessels which it is anticipated will be passed into the Fleet Reserve would require a good deal more than ten thousand officers and men, for the five battleships alone will require a complement of 3,750.

Comparisons of Naval Programmes.

Some interesting facts relative to the amount of money which is spent every year on the navies of the various great Powers appeared recently in a daily contemporary. The figures given endeavour to show, by a comparison of the naval expenditures of the great Powers for the last ten years, that we are still a good deal behindhand as regards the naval construction of this country and its rivals on the sea. We are informed that during the last ten years the expenditure on naval construction averaged sixteen millions a year, which was not quite so much as the amount expended by France and Russia combined. This way of looking at the question, however, is not exactly the right one, for it is well known that in Great Britain the naval authorities get better value for their money than do the navy departments of other countries. In much the same way the writer makes out a table showing the relative strength of Great Britain, France, and Russia in battleships, cruisers, torpedo boats, &c., but omits to state that France and Russia have a great many more old-fashioned and practically useless vessels than this country; for instance, he shows that in battleships we are four behind our two rivals, that we have two armoured cruisers less, fourteen coastguard ships less, four torpedo cruisers less, and one hundred and seventy-seven torpedo boats less; the only vessels in which we have any preponderance being, what the writer styles, "ordinary cruisers," of which we have a majority of fifty-six, and torpedo-boat destroyers, of which we have a majority of one hundred and four. However, such articles as these help to keep up the interest of the public in the Navy, for if only optimistic views were taken of our naval strength, it would not be very long before the need for another Navy League would be felt.

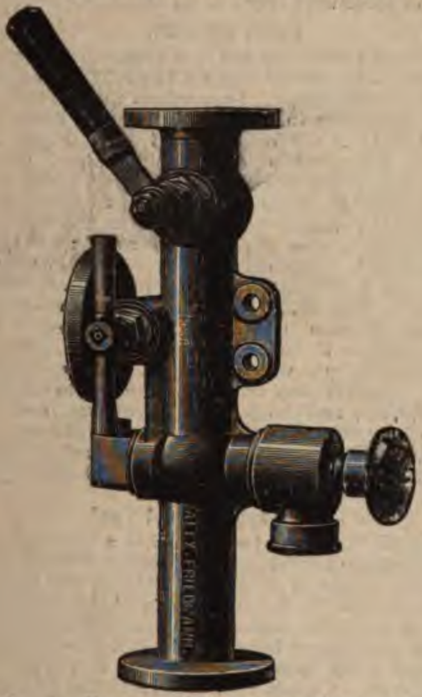


FIG. 4.—FRIEDMANN'S RESTARTING INJECTORS.
(*See page* 69.)

Devonport Dockyard.

The various vessels under construction at this yard all continue to make good progress. The *Bulwark* has not had so much material worked into her as had the *Implacable* when she had been on the slip a corresponding length of time, but this is chiefly due to the bad weather which has been experienced, as the men had some difficulty in working in the gales and storms. Her rate of progress, however, is rapid, and she is not likely to be delayed by the non-delivery of castings, as the stem-piece was unshipped here over a month ago. The competition which existed between the various yards 12 months ago is, to all appearances, not being repeated in the case of the *London*, *Bulwark*, and *Venerable*. Never before have three battleships been building at this yard simultaneously. The *Ocean*, however, will shortly leave here, as she is being prepared for sea as rapidly as possible. Some trouble has been experienced in obtaining a sufficient number of skilled mechanics, and this state of affairs can only be remedied by the Admiralty doing away with some of the restrictions and increasing the pay of the men. A sad accident happened at the Keyham Factory a few days ago, which resulted in the death of Harris Brown, a first-class student. It appears that he was tampering with machinery which he did not know much about, and no one in authority being near to stop him he continued to do so with fatal results. A student who is making his mark at this place is Mr. Percy Goodyear, who entered the college in 1895 as an engineer student. He gained the highest number of marks in advanced mathematics at the last examination, and thereby carried off the prize. The *Collingwood* narrowly escaped ramming another vessel, the *Traveller*, in the early part of last month. She was, however, prevented just in time.

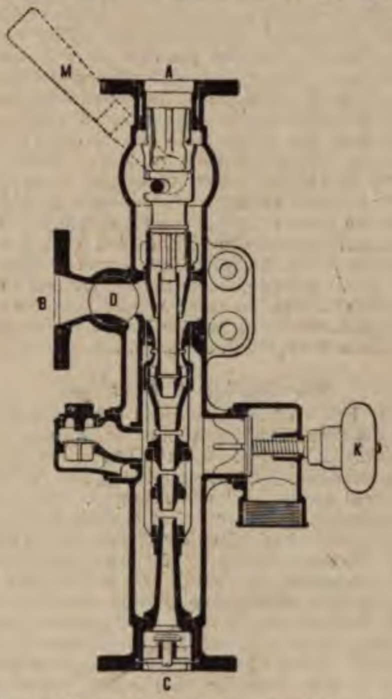


FIG. 5.—FRIEDMANN'S RESTARTING INJECTORS.
(*See page* 69.)

The Speed of Torpedo-boat Destroyers.

The speed of torpedo-boat destroyers is rapidly on the increase. The preliminary steam trials of the new torpedo-boat destroyer *Albatross*, on the Maplin Sands, a couple of weeks ago, showed that this boat is capable of steaming at a speed of more than thirty-two knots, or about thirty-seven miles an hour. Messrs. Thornycroft are the builders of this fast vessel, which is practically an experimental boat, one of several which were ordered by the Admiralty about eighteen months ago. The weather at the time of the trial was very squally, but, in spite of this, a mean speed of 32·294 knots was obtained on the measured mile. The *Albatross*, however, was on this occasion running with the wind and tide, and when she steamed back against the tide and in the teeth of the wind her speed fell to 30·303 knots. In all the circumstances this was very good, and the builders are to be further congratulated on the fact that no mishaps occurred to the engines or boilers. The *Albatros* is 227 ft. in length, has a beam of 21 ft. 3 in., and a draught of

8 ft. 6 in. Against this excellent record, however, must be placed the trial of the Chinese torpedo-boat destroyer, *Hai Lung*, a vessel built by Messrs. Schichau, of Elbing This boat is 193 ft. 6 in. long, has a beam of 21 ft., and displaces 280 tons. At a trial in the open sea, with all weights on board, and 25 tons of coal, this vessel made 35·2 knots, a little more than forty miles an hour. This, however, was with forced draught, for with natural draught and sixty-seven tons of coal on board, the *Hai Lung*, only made thirty-one knots. But there is still a chance that we may have a faster boat than the Chinese torpedo-boat destroyer when the first of the new *Turbinias* takes the water. The original *Turbinia*, it should be remembered, was only a quarter the size of the *Hai Lung*, and yet made thirty-five knots. In addition to which we do not yet put great faith in foreign trials.

Naval Works.

It has at last been decided to commence work on the new naval barracks at Portsmouth, and the contract for the work has been given to Messrs. Lovatt & Co., who are to commence operations immediately, and complete the work in three and a-half years. Sixty-two and a-half acres are to be taken up by the new buildings, which is probably the largest area of ground used for the purpose in Great Britain. The cost is to be £400,000, and when completed the new barracks are to accommodate 5,000 men. The old Anglesea barracks are not to be pulled down, but the inside is to be practically rebuilt. The present Station Hospital is to be removed to make way for the officers' quarters, but before this can be done a new station hospital is to be built on Portsdown Hill. Taking into consideration the fact that it is now three years ago that two and three-quarter millions sterling was set aside for this and other naval works, the same amount in 1897, and that the total payments for the three years ending March 1st, 1898, gave an aggregate expenditure of £2,126,747, there seems to have been some delay in completing the contracts for the various works. The amount expended should be more nearly approximate to that estimated, or the conclusion is forced upon us that more money is asked for than is required, or that it is asked for before it is wanted.

The Docking of Warships.

The return home of the first-class battleship *Victorious* has brought to the front the question of docking accommodation for ships on foreign service. On the China station the largest dock is that belonging to the Hong Kong and Whampoa Dock Co., which will easily hold the *Powerful*, but, in the opinion of the commander-in-chief on that station, is not quite wide enough for the *Victorious*. In view of this the statement which was made at the annual meeting of the company mentioned by the chairman is most interesting. He stated that the matter of docking vessels of extreme dimensions had occupied the attention of the directors for some considerable time, because it was found very difficult to provide the necessary accommodation required for many of the larger vessels now trading to the port. With a view, however, to meeting immediate wants it had been decided to lengthen the Admiralty dock fifty feet at an approximate cost of about 25,000 dollars, and while this work was being carried on the dock would continue to be available for docking purposes. He stated that it was of the utmost importance that they should possess every facility for docking the largest merchant vessels, for that otherwise the accommodation would be provided elsewhere, and would be the means of bringing keen competition into their business. He also stated that, as the larger type of vessels were increasing in number, the time was approaching when they would have to recommend to shareholders the necessity for constructing a new dock on the same lines as the Admiralty dock, but having a length of 750 feet on the blocks. This is good news, but if the intelligence from America to the effect that by electro-plating the bottoms of vessels docking can be dispensed with for an indefinite period be correct, then the necessity for new docks abroad will to a certain extent, disappear. But this news must be accepted with all reserve. If it is true, an enormous saving in money would result in the long run, and ships would not have to be withdrawn from places where their services are likely to be needed for the purpose of being docked, as in the case of the *Victorious*, The bottom of a small vessel might be electro-plated as a test.

Sheerness Dockyard.

Of the ships building and completing here the *Pomona* has not yet passed into the Reserve, although she is on the point of doing so. She is to be commissioned for service on the East Indies Station on the 18th of this month to take the place of the *Redbreast*. She has concluded the whole of her trials successfully, but has yet to go to Chatham to have her underwater fittings examined. The *Pomona* has proved herself the fastest cruiser of her class, as it will be remembered she made 20·2 knots under very bad weather conditions. The *Warspite*, upon which a considerable sum has been spent during the past three months, has at last left for the Pacific Station. Nine years ago she left this place for the same station, on her first term of service afloat, flying the flag of Admiral Hotham, and under the command of Captain the Hon. Hedworth Lambton. The *Edinburgh* has taken the place of the *Sanspareil* at this port as the flagship of the commander-in-chief, and the *Sanspariel* is to be at once taken in hand for repairs, and will not be able to resume her place as guard-ship until the end of next month. The repairs necessary are mainly connected with her machinery and boilers. On the 4th of this month the *Partridge* once again hoists the pennant. She is to leave on that date for the Cape of Good Hope and West Coast of Africa Station. The repairs on her have included a number of her bottom frames being replaced, as a number of these were found to be defective.

Refits for 1899.

The financial year which has just commenced promises to be a particularly busy one as regards the refit and repair of warships at home and abroad. In previous numbers the names of the vessels which are to be taken in hand at home have been given. Abroad, the *Revenge*, *Royal Oak*, *Royal Sovereign* battleships, the torpedo depot ship *Vulcan*, the gunboat *Cockatrice*, and special-service vessel *Imogene*, are all to undergo repairs or refits at Malta. Close upon £9,400 is to be spent upon each of the battleships, and £7,300 on the *Vulcan*. £5,920 is also to be spent upon the *Centurion* at Hong Kong, and the store-ship *Humber*; the sloops *Algerine* and *Phœnix* and the surveying vessel *Waterwitch* are also to be dealt with at this place. At the Cape £2,850 is to be spent upon the *Monarch*, and the gunboat *Widgeon* is to have a refit. Turning to Bermuda, only one vessel is to be taken in hand at this place. This is the *Indefatigable*, upon which £6,400 is to be spent in refitting her. In Australia the cruiser *Tauranga* is to be repaired at a cost of £4,800, and the gunboat *Karrakatta*, and the sloop *Torch* are also to undergo refits, the *Karrakatta* at a cost of nearly £3,000. Esquimault is also to have its share of work, for the surveying vessel *Egeria* is to have £1,690 spent upon her at this place.

The Supply of Oil Fuel.

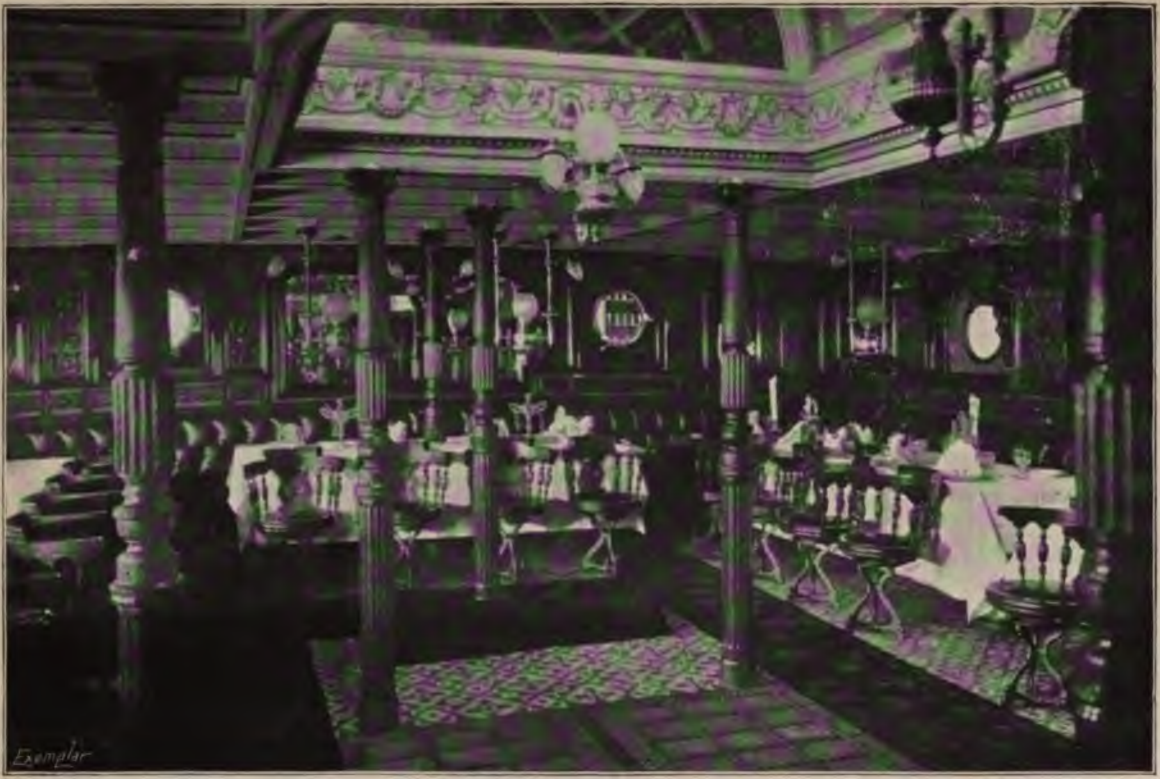
Where good oil fuel can be obtained at a moderate price, and with some degree of constancy, are questions which have often exercised the minds of those interested in the application of petroleum as fuel for warships. Tests have been made with Russian oil and with mineral oil from other sources, but as regards the oil obtained from Russia, it has been asserted that that country would have it in its power to cut off the supply if it thought fit. Canada now appears in the field with an oil which it claims is specially adapted for use as fuel. In the oil fields of West Ontario twenty-eight million gallons of crude petroleum are produced annually, and the oil is said to be of a heavier specific gravity than the United States' oil, and contains a larger percentage of carbon than either the Russian or American oil. Oil fuel, it appears, has been used in Canada for the last twenty-five years under ordinary steam boilers, and no difficulty whatever is experienced in applying this admirable system of heating by liquid fuel wherever it is desired to use it. The combustion is absolute and complete, there is no trace of smoke visible where this petroleum fuel is used, and the heat can be regulated and controlled with great ease and precision. The oil used is not the crude petroleum just as it is pumped from the rock, but a residuum which is obtained after the distillation of the water and lighter hydro-carbons from the crude, which are of little use as heat-giving elements. The partial failure of the trials on the *Surly* is probably due either to the quality of the oil used or the inferiority of the burner, but if the non-success is due to the first-named, the Canadian petroleum might be given a chance. It would be better all round if England could rely upon her supply of liquid fuel for her warships from her colonies instead of going to Russia or the United States for it. Oil that requires very little treatment, and is practically odourless, can also be obtained from Borneo.

Chatham Dockyard.

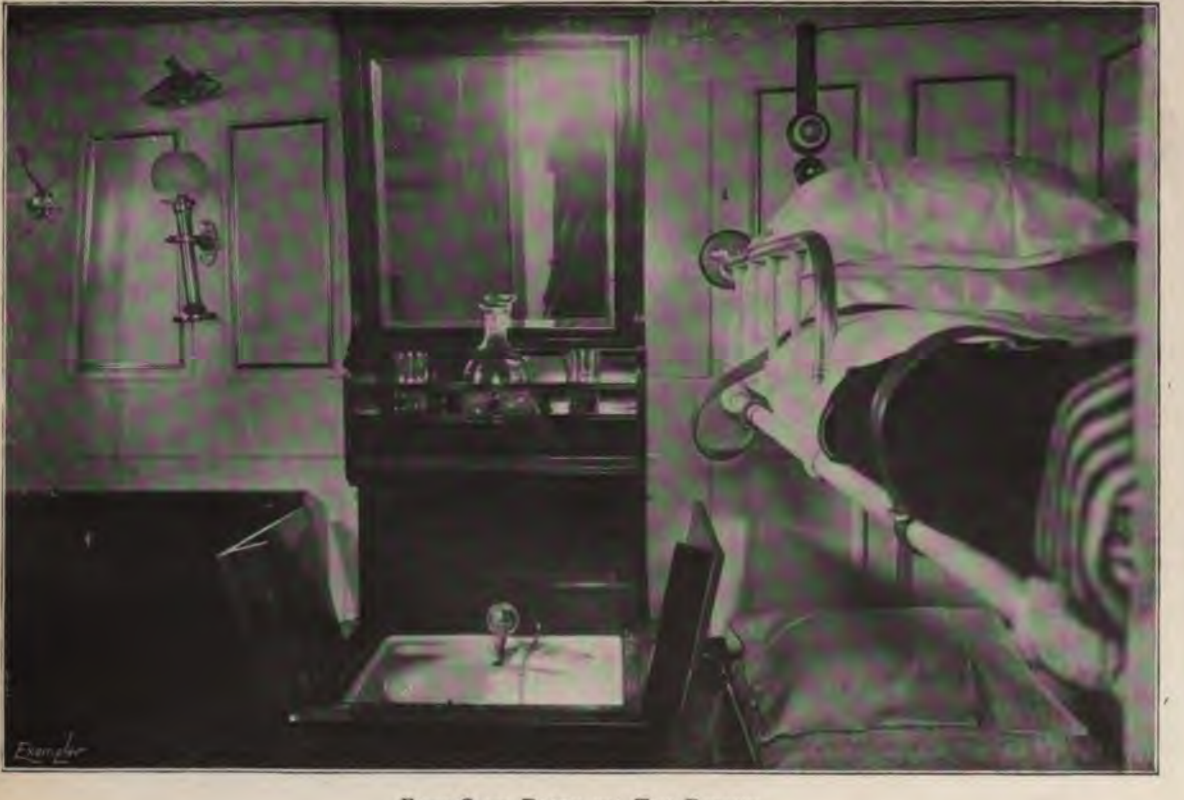
With the *Venerable* and *Cruiser* building, and the *Goliath* and *Irresistible* completing, in addition to several vessels undergoing

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS.

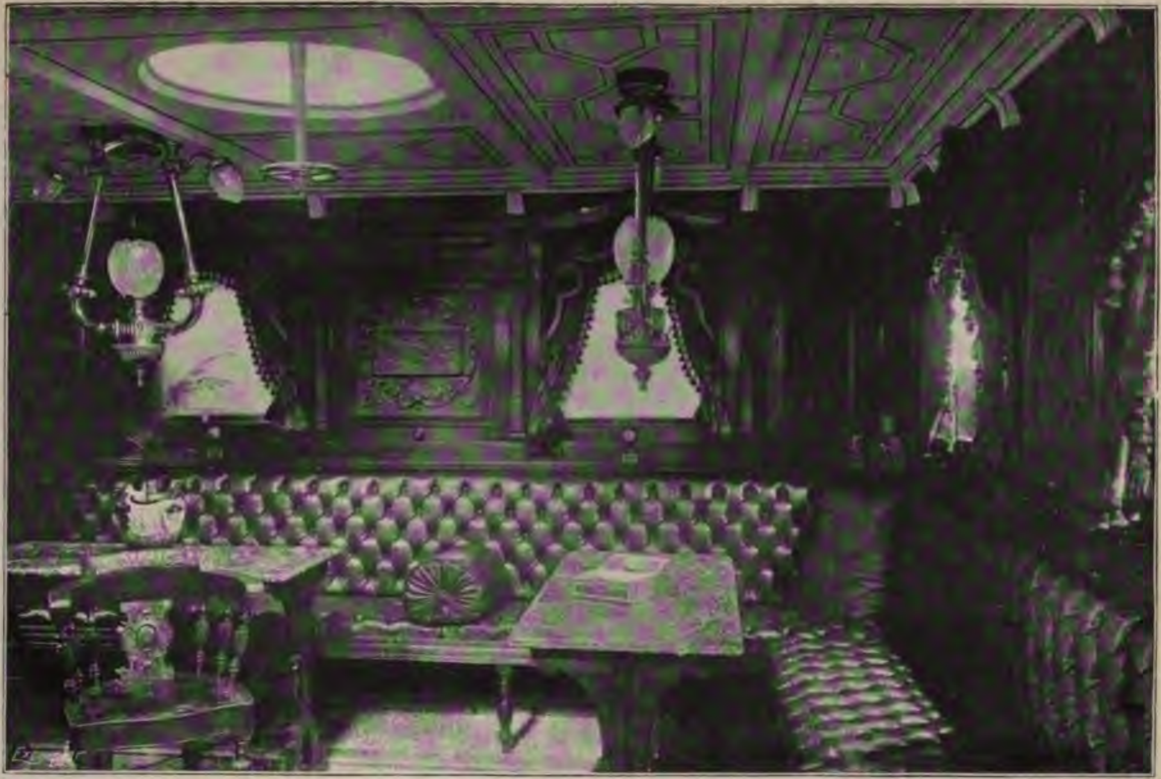


FIRST-CLASS SALOON.

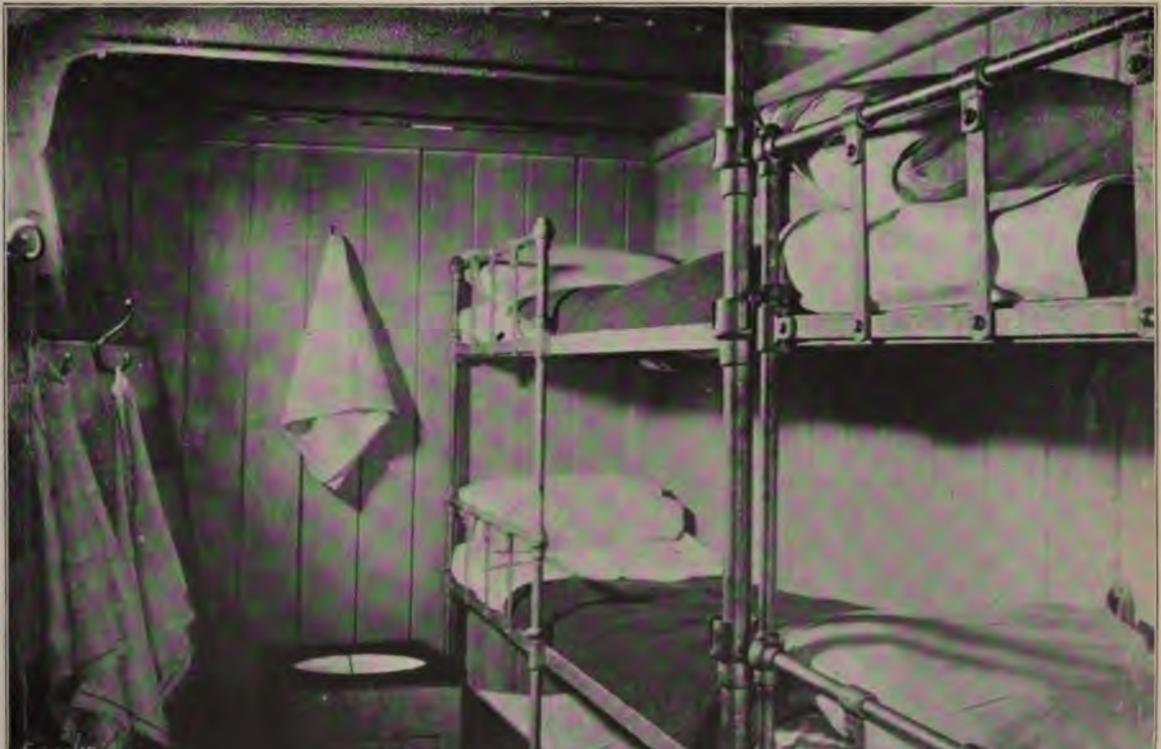


FIRST-CLASS BERTH FOR TWO PERSONS.

R.M.S. "ARCTURUS," BUILT BY MESSRS. GOURLAY BRO



A Corner of the Smoke Room.



Emigrants' Berth.

FOR THE FINSKA STEAMSHIP CO., FINLAND. *Agents—Messrs John Good & Sons, Hull.*

a refit, there is plenty of work at this yard for all hands. As regards the first-named battleship, it is probable that she will be launched about the end of July. The estimated cost of material and labour is £845,000 for this ship, but it is expected that this will fall short of the real amount required by some £20,000. While the Japanese cruiser *Tokiwa* was at this yard she had her launching gear removed, her under-water fittings completed, and her bottom covered with anti-fouling composition. The cost will, of course, be defrayed by the Government of Japan. We have refitted here the *Forte*, *Sanspareil*, *Astrea*, *Severn*, *Swordfish*, and *Dreadnought*, and work on the whole of these vessels continues to make good progress. The *Dreadnought* has been supplied with a new set of boilers, and a preliminary trial turned out quite successful. The boilers were constructed at this yard, and the speed obtained was a good deal over 13 knots, so that the engineering staff here is to be congratulated. She is to be passed into the A division of the Medway Reserve, and will probably be commissioned for service in the Reserve Squadron. The refit of the *Warspite*, which has just left for the Pacific Station, cost nearly £20,000. This includes a new armament of ten 6-in. quick-firers.

A Good Story.

The letters on the naval-engineer question which recently appeared in the *Morning Post* over the *nom de plume* of "Reform" have at last come to an end. This is not to be regretted, for their tone was much too violent to allow of any good resulting from their publication. One of the questions with which "Reform" dealt with, it will be remembered, was that of giving naval engineers the authority to punish their own staff, and in connection with this question rather a good story recently appeared in a contemporary. It appears that Admiral Sir Vesey Hamilton was one time first lieutenant of the frigate *Desperate*, commanded by Captain Dunning White. Captain White one day informed Lieutenant Hamilton that he intended to delegate to the chief engineer the authority to punish the stokers, with which the lieutenant did not agree. "You can't do it, sir," he said frankly. "You may retain the authority yourself, or you may delegate it to me, but the regulations won't allow you to delegate it to anyone else." The skipper, however, was determined to have his own way and said so, whereupon Lieutenant Hamilton declared that, if he were stripped in this way of part of his powers, he should decline to act as first lieutenant at all. "Then I'll do without you, sir!" was the skipper's prompt response, and do without his 'first luff" he did. From that day Lieutenant Hamilton took his place as one of the junior lieutenants, and meanwhile the captain carried out the duties of first lieutenant himself. This lasted through the summer. but when the winter came, and the ship was daily encased with ice, it was too much for the skipper, and he gave in. Sending for Lieutenant Hamilton he told him "carry on" again. "And the stokers, sir?" said Lieutenant Hamilton. "Oh, d—— the stokers; you can do what you like about them!" Admiral Sir Vesey Hamilton, says the writer of this story, is now reputed to be the only officer on the flag list who is in favour of naval engineers having the authority to punish their own staff, but the gallant old admiral writes to say that this is not the case, and that he is still of the same opinion as when he was a lieutenant.

The Trials of the "Amphitrite."

The series of steam trials to which the new first-class cruiser *Amphitrite* has been subjected came to an end two weeks ago. In the course of these trials those in charge of the machinery endeavoured to solve the question whether the steam first used in pumps and other auxiliary machinery could be subsequently used in the evaporators for making fresh water for the boilers. The experiment was a success. As regards the ordinary steam trials, everything went off as well as could be wished for. On her first 30 hours trial at one-fifth of the full power the *Amphitrite's* rate of fuel consumption was 1·54 lbs., with an I.H.P. of 3,751, which is considerably less than the coal consumption of the other vessels of the same class, with practically the same I.H.P. On the second trial the machinery worked splendidly throughout, although severe weather conditions were experienced. This trial, which lasted 30 hours, showed that the mean power was 13,695 I.H.P., the coal consumption being 1·48 lbs. per I.H.P. per hour. After this came the gun and circle trials, and then the full-power trials, on which the contract conditions were exceeded. The mean power for the eight hours was 18,229 I.H.P., the ship being at her full displacement; and as regards the coal consumption, it proved to be the lowest yet recorded for water-tube boilers. Messrs. Vickers, Sons & Maxim are to be congratulated on the results obtained.

Warship Building in the United Kingdom.

According to Lloyd's shipbuilding returns for the past quarter the total tonnage of warships now building in the United Kingdom amounts to 434,065 tons. Seventeen vessels representing 152,870 tons are under construction at the Government yards and 281,195 tons, representing sixty-nine vessels, are accounted for in the private yards. Three first-class battleships are building at Chatham, three at Devonport, three at Portsmouth, one at Barrow, one at Birkenhead, and one at Jarrow, and orders for three others have been obtained by the Thames Ironworks Co. At Barrow one first-class armoured cruiser is under construction, two at Clydebank, and two others at Govan, each of these vessels to displace 12,000 tons. One first-class cruiser, three second-class, and four third-class, in addition to four gunboats and six sloops, are also under construction in this country for the Navy. Five torpedo-boat destroyers are in hand at Clydebank, three at Chiswick, and three at Hebburn, and five others in different parts of the country. Thirty-one vessels are in hand for foreign Governments, of which there are on the stocks at Elswick six armoured vessels, three protected cruisers, and two torpedo-boat destroyers. The Thames Ironworks Co. are building a battleship for Japan, and Messrs. Yarrow are building four destroyers and five torpedo-boats for our "friends" the possible enemy.

Pembroke Dockyard.

At the present time, work on the new Royal yacht takes precedence of everything else. A week or so back Sir William White and Rear-Admiral Fullerton visited this yard, and spent a good deal of time on board the new vessel. Efforts are being made to have her as far advanced as possible when she is launched, for the Duke of York is to make an inspection of the ship on the day following this event. The Duke and Duchess of York are to arrive at New Milford on the 8th inst., but will sleep that night on board the present *Victoria and Albert*, prior to giving the name at present borne by this vessel to the new yacht. The copper sheathing of the new vessel is finished, and she received her first coat of paint some few weeks back. The carved work which is to be placed on the bows will be put up on the day of the launch, but afterwards removed. Roughly speaking, the estimated cost of the new yacht is to be £354,000, and not, as has been stated in some papers, "nearly a million." Although so much attention is being given to the new Royal yacht, the new armoured cruiser *Drake*, which is preparing to build here, is not forgotten. Most of her keel-plates have been prepared, and some of them temporarily connected together.

The British and French Squadrons in Italian Waters.

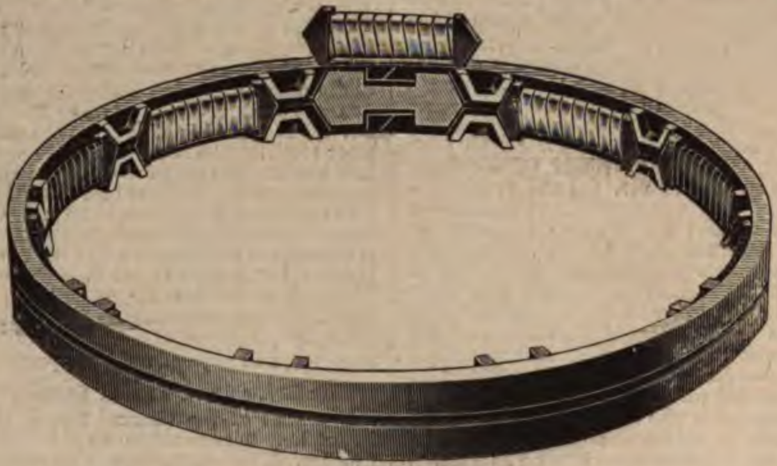
The visit of the Channel Squadron to Sardinia, will, it is hoped, help to cement the good feeling between Italy and this country. There appears to be no need for jealousy or mistrust on account of the kind reception given to the French Squadron, for it is to Italy's interest to do all in her power to keep open the Mediterranean, and therefore it would not pay her to listen to overtures made by the French. Admiral Fournier entertained the Italian officers on board the *Brennus*, and on this occasion said that he hoped to see a more rapid expansion of the Italian Navy. He is also reported as declaring himself much pleased at the reception given to the French Squadron, and expressing a hope that the reception would make an excellent impression in France by affirming once more the fraternity of the two countries which have so much interest in coming to an agreement. France and Italy are always likely to be in agreement if the latter country chooses to give way to the former's pretensions. The British Squadron arrived in the Gulf of Aranci on the 17th of April, and is to remain in Sardinian waters until the 2nd of this month, visiting during its stay the Gulf of Palmas, Cagliari Bay, Porto Conte, and the roadstead of Alghero. Altogether there were eighteen British warships, fifteen French, and fourteen Italian.

The Kaiser in a new Role.

From the news to hand it appears that William II. of Germany has taken upon himself the direct personal command of his navy, and a cabinet order has been issued having regard to the new organisation. The "Ober-Kommando der Marine," has been dispensed with, with the exception of one branch, which will be known as the "Admiralstab der Marine," with headquarters at Berlin. Prior to its being done away with, the "Ober-Kommando der Marine," controlled and directed the Baltic and North Sea stations, the squadrons, and the inspectorates of ordnance, torpedo matters, the marine infantry, and the training. Rear-Admiral Bendemann is to be the chief of the staff of the new Admiralstab Der Marine, and is to be directly responsible to the Emperor, who will, through the staff, direct the "politico-military affairs connected with ships on foreign stations." The chiefs of the two naval stations, the inspector of training, as well the commanders of the first squadron and cruising squadron are all to be immediately subject to the Emperor. The general result of these and other changes will be, too, to place the Emperor in practically the same relations with the fleet as he is with the Prussian army.

THE CLYDE PISTON RING.

WHEN high pressure steam gets behind the piston it presses it with considerable force against the cylinder walls and so causes much friction. Were it possible to prevent the ring from expanding beyond a certain amount it would be ensured that the pressure producing the friction would not exceed a certain amount. This the Clyde piston ring, sold by Messrs. John Turnbull, Junr. & Sons, of 39, Victoria Street, Westminster, London, and 18, Blythswood Square, Glasgow, provides for. It will be seen from the figure that the ring is kept from springing out too far by means of the holder with the enlarged ends. This fits into a place made for it, and being of H shape keeps the ends from going further than a definite distance out.



The packing itself is practically a plain ring kept tight between the piston head and junk ring with a ready means of adjusting lateral wear. The clip-lock ensures perfect steam tightness with minimum friction. The springs in the ring are interchangeable, except that fitted at the cuts of the ring. These openings in the ring are always kept in line in the same section, and not placed at right angles or opposite. The lock heads are reduced from time to time to adjust the wear and the expansion.

They have been fitted into the cylinders of engines in the Donaldson Line, Bell Line, and other lines.

Messrs. Echalaz & Leith, of Newcastle-on-Tyne, have been appointed sole agents in the North-East Coast district for the well-known Sheffield firm of steel manufacturers, Messrs. Thos. Firth & Co., Limited. In our announcement of this appointment in the April number the name of the first-mentioned firm was given incorrectly.

ELECTRICAL NOTES.

(From our own Correspondent.)

THE wireless telegraphy, which is so much to the fore in the ordinary newspaper at present, and as it is destined to be of moment to all who go down to the sea in ships, so the first message transmitted across the Channel will be of interest to all those who take a deep interest in this subject. That message was despatched to the *Times* on Tuesday, the 28th of March, and runs as follows:—"Communication between England and the Continent was set up yesterday morning by the Marconi system of wireless telegraphy. The points between which the experiments are being conducted are South Foreland and Wimereux, a village on the French coast two miles north of Boulogne, where a vertical standard wire, 150 ft. high, has been set up. The distance is 32 miles. The experiments are being carried on in the Morse code. Signor Marconi is here conducting the trials, and is very well satisfied with the results obtained."

This as a working system has been greatly successful, and it will be of still further interest to consider Signor Marconi's explanation of it. He first began with a distance of 1¾ miles, and noticed that a very small movement of the transmitting reflector was sufficient to stop the signals at the receiving end, which could only be obtained within a latitude of 50 ft. to the right or left of the centre of the beam of reflected radiations. The receiving apparatus is placed in the focal line of a reflector, and within range of the oscillator, and the bell will ring only when the reflector is directed toward the transmitter, and will not ring when the reflector is not directed towards it. If the reflector is caused to revolve by clockwork or by hand, it will therefore give warning only when occupying a certain sector of the circle in which it revolves. It is therefore easy, in the case of a ship in a fog, for it to make out the direction in which another ship may be signalling to it; and by the conventional number of taps or rings she will be able to discern either a dangerous point to be avoided, or the port or harbour for which she is endeavouring to steer. He succeeded in signalling over a distance of 2½ miles, and by means of reflectors he succeeded in signalling over 1¾ miles, mentioned by Mr. Preece at the meeting of the British Association of 1896.

In the beginning of last year a station was erected at Alum Bay, Isle of Wight, and another at Bournemouth, the distance between being 14½ miles, in order to test the practicability of the Marconi system under all conditions of weather. At Alum Bay the station was in the Needles Hotel, and in Bournemouth at Madeira House, South Cliff. At each station a pole 120 ft. high was used, which supported the aerial conductor, a stranded conductor of 7·20 copper wire insulated with rubber and tape. A 10-in. induction coil is used at each station worked by a battery of 100 Obach cells M size, the current taken by the coil being 14 volts from 6 to 9 amperes. The spark discharge takes place between two small spheres about 1 in. diameter, this form of transmitter having been found more simple and more effective than the Righi oscillator. The length of spark is about 1 centimetre. The experience was that no kind of weather can stop, or seriously interfere with the working of such an installation. In September of last year the station at Bournemouth was transferred to the Haven Hotel, Poole, making the distance eighteen miles. Better instruments allowed the height to be reduced to 80 ft. An average of 1,000 words were daily transmitted. In May of last year Lloyd's asked that stations should be placed at Ballycastle and Rathlin Island in the north of Ireland. The distance was 7½ miles, of which four were overland, and the remainder across the sea, a high cliff intervening. At Ballycastle a pole 100 ft. high was used to support the wire; at Rathlin the lighthouse supported a pole 80 ft. high. At Rathlin the lighthouse keepers soon learned how to work the wires, and the station was worked by them alone. In July the Dublin *Daily Express* asked that the results and incidents of the Kingston Regatta should be reported. A station in the grounds of the harbour master of Kingston was made, and a pole 110 ft. high placed. A steamer, the *Flying Huntress*, followed the yachts. The height of the vertical wire on the mast was 75 ft. A telephone was fixed at the station on land and connected with the *Express* office, and the messages sent in as they came were published in succeeding editions of the paper. Over 700 messages were sent and received. With a height of 80 ft. on the ship communications could be made at a distance of 25 miles. The curvature of the earth interfered at long distances. Three stations were installed at Cowes. The height of the pole at Osborne House was 100 ft., and the conductor was suspended to the top of the mast of the royal yacht *Osborne*, the height of which was 83 ft. from the deck. The vertical conductor consisted of a 7·20 stranded wire at each station. The distance was 1¾ miles, the hills of East Cowes were between the two stations, and the one could not be seen from the other. Uninterrupted communication was maintained between the royal yacht and Osborne House during the sixteen days the system was in use. Here is one of the messages:—

"From Dr. Fripp to Sir James Reid.

"H.R.H. the Prince of Wales has passed another excellent night, and is in very good spirits and health. His knee is most satisfactory."

Electro-plating the Hulls of Vessels.—The tug *Assistance*, an ocean-going boat, was electro-plated and launched on Feb. 22nd, 1895, and a short time ago, when hauled out of the water and examined, she was found to be absolutely free from barnacles. For the last year she has been touring in the lower waters of the Chesapeake, and remained constantly at work while other tug boats had to be taken out every four weeks. The method consisted in the use of flexible shallow box-shaped baths open at one side, each bath containing a copper electrode and the plating solution, the bath being made water-tight by flexible packing at the edges. The baths are made to follow the curvature of the vessel by means of tension ropes, screw stems, or by magnets attached to the frame of the bath. The vessel is made the negative pole by connection with an electric generator, the plating bath is the positive electrode; and the plating of the hull is accomplished by shifting the baths from the plated to the unplated sections, and slightly overlapping upon the sections already placed so as to form a continuous coating. A current of 7½ amperes per square foot and a difference of potential of 1¼ volts are sufficient to deposit a uniform coating on the surface of the vessel. To keep the density of the solution uniform, circulation is effected by permitting the solution to flow into the bottom and out near the top of the bath. A single deposit can be made in less than three days, and the whole bottom of the ship can be plated in eight or nine days.

150-ton American Electric Crane.—The Newport new shipbuilding dry dock in Virginia has fitted in it a 150-ton revolving derrick electrically operated, mounted on a steel tower supported on pile foundations. The derrick jib is capable of having its outer end raised or lowered, thus giving to the hoisting blocks which depend from this end a movement of rotation about the centre of the derrick, but also of translation in or out of the centre. With the outer end of the jib in its lowest position the hoisting blocks will in rotation of the derrick describe the circumference of a circle 207 ft. diameter; with the jib in its highest position these blocks in rotation describe the circumference of another concentric circle 88 ft. in diameter. Weights up to 70 tons may be handled throughout the entire range. The derrick, says *Electrician*, is revolved by duplicate sets of machinery, each consisting of one G.E. 800 railway motor capable of developing 20 H.P., and driving, by means of a double threaded worm and wheel, a pinion which, engaging a horizontal circular rack on the outside of the tower, gives the required rotation. The racking movement of the jib is effected by a 10 in. steel pin carrying 22 cast steel sheaves, each sheave of 5 ft. pitch diameter at the inner and upper apex of the jib, and at the upper apex of the housing is another 10 in. steel pin carrying 24 sheaves. Two 1¼ in. steel ropes carry the weight of the jib and load by leading over the sheaves, each rope being bound in alternate sheaves, and each end of each rope brought down to separate drums located below in the housing, and by this means each rope is caused to take its share of the weight. The four drums on which these ropes are wound are arranged in pairs, each one of a pair taking opposite ends of the same rope, and each pair driven by a G.E. 2,000 series motor of 100 H.P. The drums are of cast iron 5 ft pitch, and carried in 7 in. steel shafts. The main hoists are each 12 parts 1½ in. steel wire rope leading over six sheaves, 5 ft. pitch diameter, carried in a 10 in. steel pin at the outer end of the jib. The hoists may be coupled together and operated as one hoist of 150 tons.

UNITED STATES METALLIC PACKING CO., LIMITED.

THE United States Metallic Packing Co., Limited, of the Soho Works, Thornton Road, Bradford, Yorkshire, who have been manufacturers of metallic packing for the last 25 years, have found that they have supplied in this time over 105,000 metallic packings for use in engines all over the world.

The packing, as is well known, consists of blocks faced with anti-friction metal, which are held in strong rings, having pockets or horns containing springs. The blocks are placed in pairs above one another so as to break joint. A ball joint supports the packing on one side and a spring-pressed follower on the other, so that the packing is practically floating, and keeps steam-tight without regard to the vibration of the rod. As the friction between the rod and packing is very small, the rod is practically not worn appreciably, but only receives a high polish.

With efficient lubrication the blocks wear very slowly, and we understand that many of this company's packings have given 16 years' service without renewal of blocks, which, of course, are the only parts of the packing liable to wear. In the construction of this packing special attention appears to be paid to the reduction of clearance space to the minimum, no empty space being allowed beyond that necessary to permit the vibration of the rod. Special provision is also provided to reduce condensation as far as possible. Drain valves are usually provided to permit the removal of water, core, sand, and other accumulations. Special attention has also been given to its use with superheated steam, and it gives excellent results, working at a temperature of 700°Fahr.

This packing has been fitted to the machinery of H.M.S. *Terrible*, *Ariadne*, *Niobe*, *Diadem*, *Argonaut*, *Europa*, and *Jupiter*, having an aggregate of over 120,000 I.H.P., and also to 20 other vessels of H.M.'s Navy. Then 28 ships of foreign navies have been fitted, also the steamers of the following well-known lines: American Line, City Line, Donald Currie & Co., Head Line, Union Line, Red Star Line, and most of the railway companies who have steamers of their own.

Among the very extensive stock of testimonials that have been received by the company from their customers we notice there are many people who testify to having used the packing for over 10 years without

costing them a penny in repairs, while others find they are saving from £8 to £10 per annum in packing renewal alone, an advantage which is quite apart from greater efficiency of working obtained by the use of the packing.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

THE annual meeting of the Institute has taken place, and the report shows a very considerable improvement and a steady advance. The increase of membership was 78; deaths were 13; resignations, 11; and removals, 2. The membership now stands at 1,035; the increase in the membership was thus 78, as against 55 for the previous session. The honorary secretary also specially mentions the gifts of experimental apparatus by Mr. J. H. Hallett (member), and of the promise of another apparatus by the editor of the ENGINEER; and he further informs the members that they were suggested as a result of the discussions held on water-tube boilers, coal combustion, and feed-water heaters. Both apparatus have been in working, and some good results have already been obtained from it. These will probably be given as a paper before the Institute. In pursuing these investigations the council of the Institute have given every encouragement, both by freely allowing their premises to be utilised for the purpose and by making a grant of money and placing it at the disposal of this work as it may be required. But the council have not stopped at doing this good work in their collective capacity. They have taken an interest in it individually. Some of the associate members are at present making drawings, and they will construct from them models and apparatus for experiments in the laboratory. Mr. Sage has kindly offered to provide all the brass castings for this apparatus, and Mr. Boyle has offered to supply the timbers required. Other members of council have undertaken to make some parts of the apparatus altogether. All that is now required is that the younger members should volunteer to construct the apparatus required. The models are also to be increased as soon as friends of the Institute can be got at to make them and send them in. Messrs. John Turnbull & Sons are sending in a patent Clyde piston ring and a tapered mandrel, and Mr. Whitelegg, the assistant superintendent of the London, Tilbury, and Southend Railway, is to present the Institute with a photograph of a locomotive of the London and Tilbury line. The laboratory will always be open for members to work in on Friday evenings.

The Exhibition which is to be held in Paris in 1900 will have a department relating more closely to technical science, and a committee in Paris has invited the council of the Institute to co-operate with them to arrange a conference to discuss subjects interesting to the members.

Mr. Shorey, in making his annual statement as treasurer, said that with a membership of 1,035 they had spent less than with a membership of 983. The expenditure of the former session was £974, against £914 this, which showed a saving of about £60. The recreation section showed a loss of £2, against a profit of £14 last year. Mr. Boyle, in moving a vote of thanks to the retiring president, Dr. Inglis, said, as marine engineers, they ought to be very proud indeed that their presidents "have been gentlemen who stand in the front rank of their profession, whether as scientists as Lord Kelvin, naval architects like Sir Wm. White, or consulting and superintending engineers with great responsibilities attached to their positions. Then we have had those great potentates in the shipping and commercial world like Sir Thos. Sutherland and Sir Edwyn Dawes, and engineers and shipbuilders combined like Dr. Peter Denny and Dr. Inglis. In Dr. Inglis we have one who served an apprenticeship himself, and has been in close touch with marine engineers ever since." The motion was seconded by Mr. R. Adam. Dr. Inglis wrote as follows:—"Dear Mr. Adamson,—I duly received your favour of the 27th inst. intimating the Institute's vote of thanks to me as retiring president. It has been a source of great regret to me that I have been prevented attending the ordinary meetings during the session now closed; but, as you know, I have not been in my usual state of health of late, and since August last have not been in London except at the time of the annual dinner and again in January. I have to thank Mr. Boyle for his remarks at the annual business meeting, and to express my gratitude also to yourself, to Mr. Taylor, and all the members of council for making my duties so light and agreeable.—With warmest wishes for the continued prosperity of the Institute of Marine Engineers, I am, yours faithfully, John Inglis."

Mr. A. Brown (companion) proposed a vote of thanks to the office-bearers and members of council of the Institution. Mr. W. Lawrie (member), in seconding the motion, said "that the Institute is going on and flourishing, there cannot be the least doubt, and that is mainly due to the office-bearers and council who conduct our business. Their work goes on during the whole year." Mr. James Adamson (hon. secretary) thanked the members for their vote of thanks. He referred also to the attendance at their meetings on Mondays. It was proposed that the legacy left by the late Mr. Stephens be devoted to a silver medal. The scrutineers then presented the result of the voting as follows: President, Sir James Mackay: hon. treasurer Mr. F. W. Shorey; hon. secretary, Mr. James Adamson; members of council: Mr. A. Boyle, Mr. W. L. Taylor, Mr. A. G. Crighton, Mr. A. Campbell, Mr. A. Blair, Mr. J. Blelloch, Mr. J. W. Richardson, and Mr. C. G. Newby (hon. minute secretary). Bristol Channel centre: President, Sir John Gunn; vice-presidents, Mr. M. W. Aisbitt, Mr. J. W. Wailes, and Mr. J. F. Walliker; representative to council, Mr. T. A. Reed; hon treasurer, Mr. A. E. Smithson; hon. secretary, Mr. Geo. Sloggett. Members of committee: Messrs. J. Fleming, W. Scott, D. Gibson, R. Williamson, J. Chellew, G. Rutherford, J. Boddy, and W. Simpson.

The following have been presented to the Institute during the session: Sectional model of steam engine fitted with Joy's valve gear, Jas. Stark, member; photo. Argentine cruiser, *Buenos Aires*, H. Bertram; framed photo. of the late J. H. Thomson, Mrs. Thomson; framed photo. s.s. *Milwaukee*, John Ferguson. member.

The Institute has had under notice the proofs of Scott's Code. It is in its sixth edition, and that is sufficient to show the service it has been to very many shipowners and others who would require to pay a large sum to send a message by cable home. It has been divided up by the compilers into sections under headings, and arranged alphabetically. The code is formed on the same system a the codes of engineering firms are arranged for their machines. "Will be ready in a month" is represented by one word. The first page will give an idea of the manner in which the book is made. Section 1, general; section 2, rig; section 3, tonnage; section 4, dimensions. "Is she a steamer or sailing vessel?" is represented by Fumigating. All the other questions and answers under "General" are represented by words beginning with F. The book is octavo, and is about 2 in. thick.

The Institute was again engaged considering the new rules and changes of rules for the examination of engineers for Board of Trade certificates. It was in consequence of the Institute making representations on the question that the Board of Trade requested the Institute to express an opinion on them before they were finally drafted and adopted.

Mr. Hawthorn, who was in the chair, said the effect of the rules would be generally in the direction of stiffening the examinations for engineers' certificates, and the effect of that was to raise the status of engineers. Under rule 22 there were four sub-sections which were entirely new. They were as follow—"He must be able to apply the method of testing and altering the setting of the slide valves, and method of testing the fairness of shafts and adjusting them. He must be able to calculate the suitable working pressure for a steam boiler of given dimensions and the stress per square inch on crank and tunnel shafts, when the necessary data are furnished. He must understand the construction of steering engines evaporators, feed filters, and feed heaters. He must understand the construction of centrifugal bucket and plunger pumps, and the principle on which they act." Again, under rule 23. The old rule was—a candidate for a first-class certificate had to serve as second, third, or fourth engineer in a foreign-going ship, or as second engineer in a home-trade passenger steamer. Under the new rule he had to serve as senior engineer in charge of a watch on a foreign-going steamer, or as first or second engineer of a home-trade steamer; but the vessels must at least be 99 N.H.P., and he must understand the construction of, and be able to maintain in working condition, the auxiliary machinery which is placed under his charge, viz, refrigerating machinery, electric light engines and dynamos, electric motors fitted to ship's boats, hydraulic machinery, and the various descriptions of steering gear. For extra chief certificates: "He must be able to explain the construction and working of the refrigerating machinery in use on board ship, the electric lighting plant, the steering engines, hydraulic and pneumatic engines, the pumps, and all other auxiliary machinery placed under the chief engineer's control. In order to intelligently deal with ballast tanks—the cocks, valves, and pumps of which are under the chief engineer's control—and to co-operate the more readily with the master in keeping the vessel in a safe condition, especially when she is light, and when coaling operations are proceeding, candidates are expected to possess an elementary knowledge of the stability of floating bodies."

Strong objection was expressed by several members to rule 42, which is as follows:—"An officer who has attained the rank of engineer or assistant engineer in her Majesty's Navy or Indian Marine Service is entitled without examination, if an engineer, to a certificate of service as a first-class engineer; and if an assistant engineer, to a certificate of service as second-class engineer. These officers may be examined for a certificate of competency on the same conditions as engineers of the mercantile marine."

Mr. Halliday moved that it be strongly recommended to the Board of Trade that a naval engineer should only be allowed to apply for a certificate under precisely the same conditions as an engineer in the mercantile marine.

Mr. F. Cooper seconded the motion, and it was supported by Mr. Lawrie, Mr. Mather, and others, and carried *nem. con.*

R.M.S. "ARCTURUS."

THE Finska Angfartyg's Aktiebolaget's (Finnish Steamship Co.'s) newest Royal Mail steamers *Arcturus* and *Polaris* have been built for carrying on the passenger and goods' trade between Finland and England.

In summer these steamboats run between Hull, Hango, Abo, or Helsingfors, but in winter only to Hango. They are specially built for the winter trade, and there seems now very little fear of Hango ever again being closed, as these two steamers, together with the new powerful Finnish ice-breaker, the *Sampo*, are capable of making a passage through ice of almost any thickness.

One of the two steamers leaves Hull and Finland every Saturday, being due at their destination, after a short call at Copenhagen, the following Wednesday. The agents in Hull are Messrs. John Good & Sons.

Both vessels were built and engined by Messrs. Gourlay Bros. & Co., of Dundee, and are elegantly fitted up.

We give a double-page plate of four views taken on board the s.s. *Arcturus*.

She is 294 ft. long by 38 ft. broad and 21 ft. displacement, and 1,157 registered tonnage. Her engines are triple-expansion of 4,000 H.P., driving 15 knots per hour. She has accommodation for 72 first-class passengers, 38 second, 179 emigrants, and 22 home-returning sailors.

The first-class berths, elegantly and suitably furnished, are situated amidships, as is also the particularly tastefully fitted-up dining saloon, in which more than 60 passengers can be seated at table. The saloon, besides having the several usual port-holes, has a large beautifully-painted domed skylight. Connected with the saloon is the serving-room, which is unusually capacious, and which has a lift to the kitchen, and is connected with the smoke-room by telephone. The smoke-room is on the bridge deck, and has a mosaic floor and walls decorated with exquisite carvings representing Scottish subjects—as the Forth and Tay Bridges, Piper Findlater, &c., &c. The furniture is both elegant and durable. On the same bridge deck as the smoke-room are also situated the captain's and chart-rooms. One enters through the latter into the captain's ante or workroom, to which is connected his bedroom. On the same level is the commanding bridge, which is fitted with an electric search-light, and has telegraphs and speaking tubes to the captain's, steam-steering apparatus, and engine-rooms. Yet one floor higher is built a smaller commanding bridge, from which high standpoint the captain can have a splendid view of his vessel from fore to aft.

The second-class berths are aft, and are roomy, comfortable, and splendidly furnished. From the second-class saloon a broad staircase leads up to the second-class smoke-room, which is on deck. Both the first and second-class berths are fitted with every convenience, and have lavatories and toilet-rooms. There is a splendid first-class bath-room, with fresh or salt water. On the top of the staircase leading from the first-class berths to the saloon is a daintily-furnished ladies' room. Electric light and hot-water pipes are fitted throughout, and everything speaks of comfort and luxury.

The emigrant quarters are forward—the men's at one side of the vessel and the women's at the other. They have their separate kitchen, pantry, and toilet-rooms. They have their meals served between decks. Further forward are the crews' berths, the crew consisting of 44 persons, including the stewardesses, cooks, and 14 men in the engine-room.

On one side of the corridor which runs between decks, between fore and aft, are the officers' berths and mess-room.

The steamer has three large holds and powerful cranes and winches.

Hartmann's Rahtjen's Improved Composition.—We have received from Messrs. Suter Hartmann & Rahtjen's Composiinto Co., Limited, a list of some of the vessels coated during the recent three months with the above improved composition for ships' bottoms. This list copmrises vessels of every type and class, including numerous war vessels belonging to the British and other Governments, large mail steamers, and passenger and cargo vessels trading to all parts, representing a total tonnage of no less than 1,777,928 tons, and in addition the composition has also been applied to a large amount of tonnage in various parts of the world, returns of which have not yet reached the head office. Hartmann's grey anti-corrosive paint has also been applied to a great number of vessels for inside protective purposes, such not being included in the above tonnage.

Catalogue.—The Southgate Engineering Co., of New Southgate, send us a new and very practical Catalogue of their patent Steam Pile Driving Appliances. The work is written in three languages—English, French, and German. It is well illustrated and commences with a lucid explanation of the peculiarity of the firm's device for obviating the defects which usually attend the use of flexible pipes with steam monkeys. They give a selection of the testimonials they have received from customers who have been pleased with the work their machinery has effected and with its economical results. They give data as to the amount of work which can be effected by their use. For example, at the Clacton-on-Sea defence works a 20-cwt. steam pile driver of this type has driven no less than 183 piles 12 in. by 6 in. a distance of ten feet into the ground in a working week. This is stated to be a record. At the same time the life of the flexible piping was unusually prolonged. The cost of the pile drivers of various weights is set out into the catalogue together with the code word of each, so that important orders may conveniently be transmitted by telegraph without danger of error or confusion.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from March 25th to April 24th, 1899 :—

Anderson, A. R., engineer to the *Tamar*, for the *Handy*, to date April 18th.
Apps, W. R., chief engineer to the *Forte*, to date April 20th.
Archard, A. G., assistant engineer to the *Trafalgar*, to date March 23rd.
Ash, H. E. H., engineer to the *Pembroke*, for the *Cynthia*, to date March 28th.
Ash, H. G., assistant engineer to the *Pembroke*, additional, for the *Tribune*, for recommissioning, to date March 30th.
Backler, L., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.
Baker, E. F., assistant engineer to the *Magdala*, to date March 29th.
Begg, W. (probationary), assistant engineer to the *Pembroke*, to date March 23rd, and to the *Forte*, to date April 20th.
Bell, J. F. (probationary), assistant engineer to the *Crescent*, to date May 2nd.
Broadbent, C., engineer to the *Pembroke*, for the *Lee*, to date April 7th.
Brown, P. R. T., engineer to the *Diadem*.
Brown, T. F., assistant engineer to the *Pembroke*, to date March 23rd, and to the *Forte*, to date April 20th.
Cox, A. E., chief engineer to the *Pembroke*, for the *Skipjack*, to date March 25th.
Cox, H. B. T., engineer to the *Duke of Wellington*, for the *Dove*, to date April 12th.
Croisdale, L. R., assistant engineer to the *Royal Sovereign*, undated.
Dathan, W. A., engineer to the *Duke of Wellington*, for the *Bullfinch*, to date April 12th.
Davies, R. B. (probationary), assistant engineer to the *Pembroke*, additional, for the *Tribune*, for recommissioning, to date March 30th.
Dawson, F. G., engineer to the *Vivid*, for the *Shark*, to date March 17th.
Evans, A., assistant engineer to the *Vivid*, for the *Psyche*, and for recommissioning, to date March 29th.
Freeman, B. F. (probationary), assistant engineer to the *Royal Sovereign*, for recommissioning, to date April 19th.
Garde, R. B., engineer to the *Vivid*, for the *Skate*, to date March 18th.
Gavey, A., assistant engineer to the *Royal Sovereign*, for recommissioning, to date April 19th.
Graham, W. J., chief engineer to the *Pembroke*, additional, for the *Mersey*, to date April 12th.
Hall, F. M., assistant engineer to the *Colossus*, to date March 23rd.
Ham, J. W., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.
Ham, J. W., chief engineer to the *Barfleur*, for the *Fame*, to date March 4th.
Hardcastle, C. V., engineer to the *Duke of Wellington*, supernumerary, to date April 4th.
Haves, J. E., engineer to the *Goldfinch*, to date April 7th.
Hill, C. H., engineer to the *Duke of Wellington*, for the *Viper*, undated.
Jacobs, F. G., chief engineer to the *Melampus*, for the *Gossamer*, to date April 7th.
Jones, G. W., assistant engineer (temporary), to the *Australia*, to date April 4th.
Juniper, W. V., chief engineer to the *Pomone*, to date May 18th.
Lawrence, W. G., engineer to the *Widgeon*, to date April 4th.
Ludlow, G. T. J., chief engineer to the *Duke of Wellington*, for the *Cordelia*, to date April 11th.
Ludlow, G. T. J., chief engineer to the *Duke of Wellington*, for the *Naiad*, to date April 27th.
Massey, J. S., assistant engineer to the *Duke of Wellington*, for the *St. George*, to date April 12th.
McGregor, D. J., assistant engineer to the *Pomone*, to date May 18th.
Mew, W. H. (probationary), assistant engineer to the *Renown*, to date March 27th.
Mew, W. H. (probationary), assistant engineer to the *Crescent*, to date May 2nd.
Milton, W., staff engineer to the *Pembroke*, for the *Ariadne*, to date April 22nd.
Morgan, T. J., acting engineer to the *Galatea*, to date April 19th.
Morison, R. B., engineer to the *Duke of Wellington*, for the *Europa*, undated.
Noll, G. W., chief engineer to the *Tribune*, to date May 9th.
Page, F. J., engineer to the *Pembroke*, for the *Snapper*, to date March 15th.
Pratt, W. H., engineer to the *Duke of Wellington*, for the *Crescent*, and for recommissioning.
Rampling, H. J., fleet engineer to the *Vivid*, for the *Albion*, to date April 7th.
Rawling, S., staff engineer to the *Pembroke*, as overseer at Fairfield Works, and Wilson & Co., and Clyde District, to date April 27th.
Rees, J. D., chief engineer to the *Isis*, to date April 19th.
Rider, R. T., assistant engineer to the *Terrible*, to date April 12th.
Riley, W. H., fleet engineer to the *President*, for service at the Admiralty.
Ryan, J., chief engineer to the *Vivid*, for the *Phœbe*, to date April 12th.
Sanderson, P. A., assistant engineer (temporary), to the *Colossus*, to date April 19th.
Smith, J. A., inspector of machinery, to the *Niobe*, additional, temporary, to date April 27th.
Spencer, A.P.S., assistant engineer to the *Wallaroo*, to date April 7th.
Steil, W. J., assistant engineer to the *Crescent*, to date May 2nd.
Stuart, M., chief engineer to the *Psyche*, to date May 2nd.
Sydenham, E. D., assistant engineer to the *Royal Sovereign*, undated.
Teed, H. R., engineer to the *Pembroke*, for the *Mallard*, to date March 15th.
Toman, R. W., chief engineer to the *Vivid*, for the *Thames*, to date April 19th.
Watts, J. A., assistant engineer to the *Royal Sovereign*, undated.
Webb, A. T., acting chief engineer to the *Vivid*, for the *Charybdis*, to date April 7th.
Wishart, W. L., fleet engineer to the *Warspite*, to date April 7th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE industrial record for April is virtually a repetition of that for March and February in respect of work accomplished and contracts entered into. There has been continued activity in the one case and even more accentuated stoppage than ever in the other. The output of new shipping reaches more than an average figure, while the contracts booked are few indeed, and mostly unimportant. This is doubtless an inevitable and quite legitimate—and acceptable—outcome of the abnormal condition of things which has obtained in shipbuilding and cognate industries for some considerable time now. The cessation of new orders will enable things to be brought back to something like their normal balance.

But, large as the output continues to be, it does not represent anything like the maximum possible and desirable, considering the present state of the employers' books and the orders which would be forthcoming if only greater celerity still were observed in launching and completing vessels on hand. Two influences which are notoriously at work in retarding progress are the slow and uncertain delivery of material—the delay and bother in some firms, experience being most vexatious—and the annoying waste of working time by certain branches of operatives. To a certain extent the former source of annoyance is responsible for the latter, but for most part, the loss of time by boilermakers and iron shipbuilders—the riveting sections especially—is attributable to unsteadiness, thriftlessness, and a lack of will or desire to make the very most of the present spell of good trade. For wilful and unauthorised stoppages of work on the part of members of the Boilermakers' and Iron Shipbuilders' Society, Mr. Knight, the secretary, has been soundly rating culprits in his recent reports, and certain of the Clyde employers have been publicly calling attention to the great cause they have for complaint in these connections.

Speaking at a social function in Dumbarton lately Mr. John Ward, managing partner of Messrs. William Denny & Brothers, said that at present among a good many of the workmen there was more unsteadiness than there had been in his experience of twenty-seven years. He had had special reasons for looking into this matter, because his firm had been trying to work against promised deliveries. He had taken during the last twelve months a close and keen oversight of the attendance of their men. Instead of resuming their work that day—the Tuesday following the Dumbarton spring holiday—a great proportion of the iron workers in their employ had not returned to work, and the chances were that the following day would still find them in the streets, spending both their time and money. All the heads of squads had that morning turned out, but the work could not be gone on with through the want of men. It meant a loss of about £400 worth of wages that would have been earned that day in the iron department, and the deliveries to that extent were thrown back.

This is not by any means a new trouble on the Clyde, but it has all along been noticeable that the greater the boom in the trade there has been a corresponding amount of unsteadiness and thriftlessness. Some twenty years ago when the wages of platers, frame setters, and riveters were exceptionally high, it was not uncommon for fully one-half of the "black squad" in each yard to be absent for the first two days at the beginning of a week following the pay. At the present time builders have much the same kind and degree of grievance to contend with. The workmen feel persuaded there is abundance of work for a couple of years to come, and while they can make a sufficiently adequate pay in, say, eight or nine days out of the twelve, they are unconcerned about getting the work out to contract time, unconcerned about the loss to the employer who keeps his machinery going and has besides a regulation staff to pay fixed wages. Allowing for time lost through bad weather, it has been computed that from 25 to 33 per cent. of time is lost on an average throughout the yards of the Clyde through unsteadiness of riveters and platers. The loss of time by engineers and brass finishers, it is gratifying to find, is comparatively small, and has been computed at from 5 to 10 per cent.

How far the adoption of weekly instead of fortnightly pays will help to promote greater steadiness and regularity at work is doubtful, but the feeling on the part of many of the shipyard managers and foremen is that more frequent payments will diminish the temptation to the usual "fortnightly burst," as at present obtaining with the black squad when flush of cash. It may also in other ways conduce to better working conditions. In any case the system is being introduced this month at the request of the men all over the river, and at considerably increased outlay to the employers, extra clerks having had to be engaged, and altered systems of time and book-keeping introduced.

The Fairfield Co.'s second-class cruiser *Hermes* has left the builders' dock, and after running her preliminary trials on the Firth will proceed to Devonport Dockyard to prepare for Admiralty trials. Her sister ship the *Highflyer* will follow in a week or so, and about the same time the 30-knot destroyer *Leven* will also leave for Devonport. Work is proceeding apace on the second-class cruisers *Cressy* and *Aboukir*, and a start has been made on the two additional destroyers recently ordered, as well as on the magnificent 23-knot armoured cruiser ordered about the beginning of the year.

The two splendid mail steamers for the Castle Packet Line building at Fairfield—to be called *Kinfauns Castle* and *Kildonan Castle*—have now reached the launching stage, and they will be sent off the stocks, the former early this month and the latter some time in June. These sister vessels are to be propelled by twin-screws—the first of the Castle packets so propelled—and are to be faster than any vessels now on the Cape route.

Messrs. Ritchie, Graham & Milne, of Park Shipyard, Whiteinch, continue to be fully employed with the construction of light-draught steamers and barges for inland lake and river navigation in various parts of the world, most of their productions being shipped in pieces and reconstructed at their destination. The following are some of their recent contracts:—Two paddle steamers 260 ft. long, 45 ft. beam, and 11 ft. depth, moulded, to be fitted with three lines of rails and six large turntables, enabling them to carry trains over the River Hooghly, India; four stern-wheel steamers of similar size and design, two of which are for East African river service, one for the Congo, and the fourth for the River Plate.

Messrs. Napier & Miller, Limited, the new firm who have now started operations in the shipyard at Yoker, formerly occupied by Messrs. Napier, Shanks & Bell, are already well provided with work, several of the contracts being for large cargo-carrying steamers. Two of these are vessels of 400 ft. keel, and of about 7,000 tons deadweight capacity, ordered by Messrs. Robert Mackill & Co., Waterloo Street, Glasgow, and a third of almost similar size is for another firm of Glasgow owners. Messrs. Napier & Miller, not being themselves engineers, are sub-contracting with engineering firms in Glasgow for the supply of the necessary engines and boilers for these vessels. Other work in hand by the Yoker firm are twelve cargo barges, each of about 150 tons capacity.

Messrs. Fleming & Ferguson, engineers and shipbuilders, Phœnix Works, Paisley, have received an order from the Admiralty for two lightships, one of which is intended for service at Sheerness and the other at the Cape. All departments of Messrs. Fleming & Ferguson's works are at present fully occupied.

Both Messrs. William Simons & Co., and Messrs. Lobnitz & Co., at Renfrew, are as usual busy with their own specialities in the way of dredgers and hopper barges, &c. Messrs. Simons & Co. have three dredgers in hand and three steam hopper barges, all for foreign owners. Four of the vessels are in an advanced stage of construction, the other two not being quite as well advanced. The firm have orders on the books to take the place of vessels that may be launched. In December last the firm launched the powerful dredger *Alexander Golovatcheff* for the Russian Government, but during heavy weather, when barely clear of the Channel on her way to Odessa, her main shaft broke and she had to be abandoned, her crew being taken off by the White Star Line steamer *Tauric*. On March 28th last another dredger of similar design was launched by Messrs. Simons, also for the Russian Government, and she has been given the same name. She went through severe trials about two weeks ago in the harbour of Greenock and on the bank near Craigendoran, when, it is understood, she dredged or lifted no less than 360 tons in 18 minutes.

The Clydebank Engineering and Shipbuilding Co. have begun to lay down on the berth vacated by the Japanese battleship *Asahi*, not the keel of the 23-knot armoured cruiser *Leviathan*, as wrongly reported, but that of one of the large Atlantic liners they have on hand for the International Navigation Co., of New York. It has for some time been rumoured that the Clydebank Co. bave been commissioned to build not two only, but the whole four steamers the International Co. are adding to their fleet, two of which it was the original intention to place with American builders. It now appears quite certain that the whole four vessels have been entrusted to the Clydebank Co. An official of the owning company has recently stated that the company has been unable to find a shipyard in the States in a position to undertake the building and delivery of the steamers within a time suitable for the service, all the yards being so busily engaged. It is understood, however, that a large proportion of the material of which the vessels will be built is being sent from American steel works to the Clyde. This is so, at least, with respect to the two steamers first placed with the Clydebank Co. The rudders and sternposts are being made and despatched from the works of the Pennsylvania Steel Casting Co., of Chester, Pennsylvania, each of the rudders being one solid casting.

Messrs. William Denny & Brothers, Dumbarton, extensive though their premises be, are finding it more and more necessary to utilise surplus ground belonging to them lying outside their yard wall, but quite convenient and handy to the lower yard gate. On this ground they have already built many of the light-draught barges and other craft for which the firm is noted, and they are now proceeding to erect, and equip with the necessary plant, a large fitting shed, 150 ft. long by 50 ft. broad, alongside the ground in question. This step of Messrs. Denny's may be regarded as one more of many other indications, to be noticed on the Clyde, that the development of already established, and the opening up of fresh fields of commercial enterprise, by means of inland lake and river navigation, in various parts of the globe, are matters more and more on the increase, thus entailing on our home builders—of light-draught craft especially—extra energy and enterprise in meeting the demand.

Messrs. Blackwood & Gordon, engineers and shipbuilders, Port-Glasgow, whose patent slip has lately been greatly requisitioned for the cleaning and overhaul of Clyde passenger paddle steamers, launched about mid-month the steel screw steamer *Cork* for the City of Dublin Steam Packet Co., of Dublin. The new vessel, which is 260 ft. in length by 34 ft. beam and 16 ft. 9 in. moulded depth, is to be employed in the cross-channel trade between Dublin and Liverpool as consort to the four popular steamers *Louth*, *Wicklow*, *Carlow*, and *Kerry*, which steamers were also built by the firm. The machinery, which has also been constructed by Messrs. Blackwood & Gordon, consists of triple-expansion engines of fully 3,000 H.P., and two large double-ended boilers working up to 170 lbs. pressure. The *Cork* is built on similar lines to the former steamers, but with the improvement that she has accommodation for 50 additional first-class passengers, placed in private cabins amidships. During construction she has been under the supervision of Mr. Edwin C. Ferber, the company's engineering superintendent.

Messrs. David J. Dunlop & Co., of Inch Works, Port-Glasgow, have received an order to build and engine two large steel-screw steamers for the Woermann Line, of Hamburg.

Messrs. Drysdale & Co., of Bon-Accord Engine Works, London Road, Glasgow, whose specialities in the way of centrifugal pumps are so well known, and who, as a firm, celebrated their semi-jubilee in March last, are at present completing an installation of their pumps for the working of the new graving dock shortly to be opened at Troon. Other important contracts in hand and nearing completion are a large installation at the Prince of Wales New Graving Dock, Swansea, and an installation of four compound centrifugal pumping engines for the Wakefield Sewage Works.

At the sixth general meeting of the forty-second session of the Institution of Engineers and Shipbuilders in Scotland, held in the Institution Rooms, Bath Street, Glasgow, on the 21st April, Mr. George H. Baxter, mechanical engineer to the Clyde Navigation Trust, read a paper dealing with the pumping arrangements and various contingent mechanical details connected with the Clyde Trustees' new graving dock, at present one of the largest of its kind in the world, and capable of accommodating the largest vessels afloat, having, of course, pumping machinery of like proportions.

Some interesting figures and diagrams were presented by Mr. Baxter, bearing upon the great efficiency of the machinery, and the record work it had done in the matter of emptying the enormous quantity of water contained in the dock when vessels are being accommodated. A few general particulars may be given respecting the dimensions and capacity of the dock. The principal dimensions are:—Length of floor, 880 ft.; width of floor 81 ft. 8 in.; width at top, 115 ft.; width at entrance, 83 ft.; depth of water on sill at average high water of spring tides, 26 ft. 6 in. The floor of the dock is 2 ft. above the sill, and the length of the dock is divided by a pair of steel hinged gates into two parts, the inner division being 420 ft., and the outer, 460 ft. long. When no vessel is in the dock, and with a tide 26 ft. 6 in. above the sill, its capacity, or quantity of water to be removed, is about 13¾ million gallons, equivalent to 2¼ million cubic ft., or 61,440 tons, which, in accordance with the specified test, had to be emptied in not more than two hours after commencing to pump at top of high water, at the expiry of which time the tide outside the dock was expected to fall 4½ ft. On the official trial, with a tide 26 ft. 3 in. in the outside, and 26 ft. 1½ in. in the inside division, the dock was emptied in 99 minutes, the contractors thus having 21 minutes to spare. This was good work, considering that this was only the second occasion on which they had had an opportunity of trying the machinery under test conditions.

Since that time, however, this record has been surpassed, for with a tide of 27 ft. inside and outside the time has been reduced to 90 minutes for pumping out both divisions without a ship in either of them. This meant the removal of about 66,033 tons of water, the amount in the outer division being about 35,520 tons. If, then, a vessel, displacing, say 10,000 tons, were docked in the outer division only, the quantity of water to be pumped out would be 25,520 tons. The machinery being capable of removing 66,033 tons in 90 minutes, or, roughly, on an average 734 tons per minute, it follows that with a 27 ft. tide the outer division of the dock, which is the larger, could be emptied in somewhat less than 35 minutes. This would probably be found much quicker than there was any need for, especially if a vessel of such a size had to be washed down during the process of pumping, even if it could be adequately shored up in such a short time. It is proving a matter of gratification to the Clyde trustees, and all concerned with the working of the dock, that the performance of the pumping machinery has so much exceeded the test requirements, and reflects such credit on the contractors, Messrs. Andrew Barclay, Sons & Co., Kilmarnock, and Messrs. Gwynne & Co., London, who sub-contracted for the pumps.

Mr. Baxter also pointed out in the course of his paper that through the adjacency of the three docks the older benefited from the new and its powerful pumping equipment. A branch culvert 3 ft. in diameter had been constructed from the 6 ft. filling culvert of the new dock, which communicated with Dock No. 2, an arrangement, he said, which had effected a very great improvement in the working of the latter. Owing to this and other necessary connections the pumping machinery in connection with Dock No. 1 or that of No. 3, or both sets of machinery, could be utilised for No. 2. In this way not only was it emptied much more quickly, but the long delays at the finish had been altogether avoided. This had much enhanced the value of No. 2 Dock, and was an improvement which was, no doubt, fully appreciated by surveyors and superintendents of steamers using it.

A noteworthy and highly useful item in the equipment of No. 3 dock, which was now being provided on the north side, was a 25-ton steam travelling crane with a fixed jib, mounted on a strong steel carriage, having a rail gauge of 24 ft. 9 in., and with a clear headway of 14 ft. 6 in. from top of rails to under side of cross girder. It was capable of travelling by its own power with the jib in any position with a test load of 30 tons on a set of double rails extending the whole length of the outer division, and beyond the division gates, so as to make the crane available for either division. The rake, or overhang, was 74 ft., thus extending well over the centre line of dock, the range of lifting block being from 35 ft. below to 50 ft. above the cope. The driver's house was so arranged that he could always be able to see the bottom of dock.

The Grangemouth Dockyard Co., launched about mid-month the steel screw-steamer *Irene*, built to the order of Messrs. Furness, Withy & Co., of West Hartlepool, for Messrs. M. Hulthen, of Helsingborg, and a sister ship to the *Muriel*, built by the company last year for Messrs. Furness, Withy & Co. She will carry a deadweight of 3,100 tons with Lloyd's summer freeboard, and has a low net tonnage. The dockyard company are at present exceedingly busy, having seven vessels on hand, two of them being large steamers fitted for carriage of oil in bulk.

Three of the steamers of the Laird Line—the *Brier*, the *Cedar*, and the *Azalea*, are at present receiving an overhaul on the Clyde. The *Brier*, which was built 17 years ago by Messrs D. & W. Henderson, Partick, is receiving new engines and boilers with improved passenger accommodation, electric light throughout, electric ventilating fans in 'tween decks, and other improvements. The *Cedar* and *Azalea* are getting a general overhaul, which includes the introduction of electrical light and fans of the Blackman type.

THE TYNE.

(*From our own Correspondent.*)

Shipbuilding.—Since last month nothing has occurred to re-establish a feeling of hopefulness as regards the future of shipbuilding, the surrounding conditions having, if anything, taken on a still more sombre aspect. In most of the great over-sea trades, freights have shown further depression, the downward inclination being evidently caused by the circumstance that the supply of tonnage has largely exceeded the demand. And still the launching of big cargo carriers goes on apace, so that as time goes on the evil of over-supply is likely to be further accentuated instead of lessened. The development of new trades and new countries, on which shipping people depended so much as a means of absorption for the vast carrying mediums they were bringing into existence, has not progressed according to the expectations formed, and hence the fact that a necessarily limited demand could not keep pace with a practically unlimited supply. Yet, despite the circumstance that the demand for new ships is no longer urgent, but is beyond all possibility of doubt declining, there are workmen's leaders so wilfully blind to all that passes as to think the present a suitable time for harassing the employers with demands for advances of wages. On the Clyde it would seem that the carpenters and joiners have asked for an advance, but it has been reserved for the labourers to take the initiative in this movement on the North-East Coast.

The officials of the principal labourers' union (there are three or four different unions claiming a foothold in the northern shipyards) put forward a demand for a ten per cent. advance all round; and, though the employers have had the courtesy to a deputation on the subject, they—in accordance with expectation—decided to grant no advance whatever, as their principal reason the obvious downward tendency e. We dwell upon this episode for the reason that it s an idea of the exaggerated view of their own import- hich even labourers can take when they have succeeded ing themselves into a union. Even if trade were in an akably flourishing condition, an application for an e coming in the first instance from the labourers would, tainty, meet with refusal, as it would have been against edent to begin an advance movement with the lowest class adder. The labourers have always *followed* the mechanics matter of advances, and, for that matter, in reductions d this, of course, is still the natural order of things. The ntatives of the labourers have, in trying to assume a to which they were not entitled either by custom or n sense, inflicted an injury on their constituents, ch as by their action they have raised expectations under the circumstances, could not possibly be realised. g is more unwise on the part of working-class leaders present claims which cannot be sustained by argument; h groundless and usually ill-timed requests, only create a of annoyance amongst the employers, and, if often re- may even provoke resentment. So well established is that the labourers follow the mechanics in all changes s, whether upwards or downwards, that the former could well without a trade union, and it is difficult to see in ay the latter can be of use to them. Union or no union, ages are advanced when the wages of the mechanics are d, and all the unions in existence would not enable extort an advance at any other time.

em of considerable interest to the shipbuilding and ring communities of the North is the fact that Mr. Knight, on his retirement from the position of general y of the Boilermakers' and Iron Shipbuilders' Society, retained as consulting secretary. This is a guarantee the future, as in the past, the action of this important ill be influenced by moderate counsels at the seat of nent, and that the amicable relations so long main- vith the employers will be continued. The nominations position of general secretary, now vacant, are being or in the society's current monthly report, and the will doubtless take place between now and August. tainty that Mr. Knight's hand will—in some sense— e to guide the helm, divests the question of succession of large share of its importance; as the fear that some gued offshoot of the Socialist party might get control of ety, no longer exists. The executive council have put he members a graduated scale, embodying their idea as inimum and maximum salary to be paid to the next secretary, and in this they have gone in direct opposi rade union practice, as the highest figure named by them han the amount paid to Mr. Knight, the present holder office. They actually recommend the members to do ich they would resist to the death were an employer to it against one of themselves, namely, to reduce the ttached to an office; and it is exceedingly strange that body like the Boilermakers' executive should consider n their eyes—would be an act of meanness or tyranny, by an employer, to be an act of expediency and justice ne by themselves.

er stage in a very remarkable piece of work has been ut at the yard of Messrs. C. S. Swan & Hunter, namely, uching of the forward section which has been built y to make whole and sound again the decapitated *Milwaukee*. Our readers will remember that on the of her maiden voyage in September last this vessel en ashore on the Scotch coast, and that subsequently r-part (including the engine and boiler areas) was towed yne, the forward section being irrecoverable. It was tural that the work of constructing a new forward section levolve upon Messrs. Swan & Hunter, who were the builders of the vessel; and they have amply justified ection for the performance of this onerous task by suc- putting into the water the completed section in less e anticipated time. The work of attaching the new to the salved section is still to be done, but this will e particularly difficult, and will doubtless occupy but a days. The whole work of salving and reconstruction tes quite a unique achievement, as, though numbers of have been cut asunder, and put together again after lengthening, never before has a vessel had a new forepart attached.

Messrs. Armstrong, Whitworth & Co.'s yards at Elswick and Low Walker are fully occupied with warships and merchant vessels of exceptionally large size, the latter yard being the busier of the two. The company are still engaged in carrying out alterations intended to enlarge productive scope, and during the past few weeks some important additions have been made to the machinery equipment at each establishment.

Messrs. Wigham Richardson & Co. are also busy with extension work, included in which is the creation of two additional building berths. Among the contracts in hand are three superior-type boats for the Hansa Co., Bremen, and one exceptionally large one ordered for the service of the Austrian Lloyd's.

The Palmer's Shipbuilding and Iron Co., Limited, have received from the Admiralty an order for three out of the twelve new torpedo-destroyers given out to private builders. Considering the number of firms who had competed for this work, the great Jarrow firm may be congratulated on their success in getting so large a share, and the circumstance testifies to the esteem in which the company is held by the powers that be. Messrs. Palmer have, we believe, built more vessels of this type than any other firm on the North-East Coast, or perhaps in the United Kingdom, and the experience gained has enabled them to attain special distinction in the execution of this particular class of work.

Messrs. Hawthorn, Leslie & Co. have also been among the successful competitors for Admiralty work, and the orders they have secured, with the merchant work already in progress, will keep the yard busy for some months to come. Messrs. Dobson & Co. have a good show of work on the stocks, and two vessels in the water being fitted out, a similar state of things being apparent at the yards of the Tyne Shipbuilding Co., Messrs. Readhead, and Messrs. Wood & Skinner. In the smaller yards work is plentiful, and repairing establishments are generally busy.

Engineering.—Our anticipation in last month's "Notes" with regard to the wages question has been verified, the employers having refused to grant the advance asked for on behalf of the operative engineers. The question is now in abeyance, but it is not probable that the engineers will carry the matter to the point of going on strike. Though the wages now current are higher than were ever paid before, the engineers might have been able to push them a point higher had there been no bootless struggle for a shorter working day in 1897; but in that wild attempt to attain the unattainable they effectually overstrained their resources, and rendered themselves quite powerless to do such another injury to trade as they then managed to effect. They will do very well, indeed, if they can retain their present rates of pay over the months of the current year, for it is well known that trade is slackening, and the next change in wages will be inevitably in the downward direction. In these circumstances the less said about advances the better.

Night-work is still continued at all the leading establishments, but it is thought that the time is now at hand when it will be possible to begin a gradual narrowing down of the night and overtime operations. Both overtime and night-work are, to employers, expensive luxuries, which must not be indulged in excepting under the spur of stern necessity. As soon as night-work is brought within appreciably narrower limits than at present exist, labour will become more plentiful, or, what is of equal significance, work will become more scarce, with the result that men of inferior ability or irregular habits will find it exceedingly difficult to find employment.

We understand that the efforts of Messrs. Crosier, Stephens & Co., of 2, Collingwood Street. Newcastle, to create a demand for their engineering and other specialities in South Africa, have already had very satisfactory results, some good orders having been secured, and the gentleman who has been entrusted with the charge of the firm's interests in that country being sanguine as to a further development of business.

Messrs. Clark, Chapman & Co. are extremely busy with the manufacture of marine specialities of various kinds, and in the electrical department of their works business is also prosperous.

Messrs. Thos. Proctor & Son, ship ventilator, tank, and signal lamp manufacturers, metal workers, &c., have just now an exceptionally large number of important orders on hand in connection with the equipment of vessels building on the Tyne and Wear, and at other centres. The extensions at the firm's

Gateshead works are approaching completion, and a good proportion of the new machinery is already in position.

Well-sustained activity is the feature at Messrs. H. Watson & Sons' works, High Bridge, Newcastle, the demand for the firm's well-known Westminster ballast pumps being still very active. The features of this pump are its great strength and simplicity of design, together with the very marked economy of steam effected in its working, as compared with duplex pumps of equal capacity.

Through the instrumentality of Mr. H. M. Wilson, of Crown Buildings Side, a new and interesting marine engine appliance has been introduced into this district. This is Welbury's patent racing check, which is the invention of Mr. W. Welbury, 5, Middleton Crescent, Dewsbury Road, Leeds, and is intended not to displace, but to assist the governor. It effects this object by allowing the steam under certain circumstances to escape direct to the condenser without passing through the engine. It is easy of application to old or new engines, and is suitable to most patterns of marine governors. A report just to hand from the chief engineer of the s.s. *Queen Wilhelmina*, to the machinery of which this appliance has been fitted, speaks of it in the highest terms, as being an invaluable adjunct.

THE WEAR.

(From our own Correspondent.)

WE are pleased to be able to state that Messrs. W. Doxford & Sons have decided to put down an extensive electrical installation of dynamos, motors, &c., for the purpose of driving the machinery in all their departments, as well as for lighting the buildings, yard, and riverside platform at night time. The contract has been given to that enterprising local firm, the Sunderland Forge and Engineering Co., Limited, who are just now engaged in fitting Messrs. Austin's yard with an electrical power equipment, and have the contract for a similar installation at the works of Messrs. Priestman & Co. There are, we believe, three yards on the Wear where electricity is already being utilised for machine-driving purposes, and when these other three are fitted, it will be possible to say that the whole of the leading yards have taken part in the advanced movement. The advantages of electricity, as a motive power, must be looked upon as indisputable when three of the most successful firms on the Wear evince their trust in it by adopting it simultaneously, and we have little doubt that, in the course of a year or two, its adoption will have become general.

It is understood that Sir James Laing & Sons have received an order for a couple of large vessels from a French firm, and they have also some good repair contracts in hand. Messrs. R. Thompson & Sons continue to have their berths fully occupied, and at Messrs. Pickersgill's yard there are three vessels on the stocks. It is understood that at least two of the latter are for Liverpool owners.

Messrs. Blumer & Co. are putting down a very large vessel, which, it is believed, is ordered on foreign account, and at Messrs. Bartram & Sons two vessels of about 6,000 tons capacity each are in course of construction.

Messrs. J. L. Thompson & Sons have their five large berths occupied, three of the vessels being, as yet, in early stages. It is understood that these—or three others—are ordered by a firm on the West Coast. This firm, who are usually identified with every forward movement have, we are able to state, definitely decided to adopt the system of "joggle" plating, patented by Messrs. Doxford, and have ordered a "joggling" machine, or "roller-press," of the largest power to enable them to put their resolution into effect. This will make four firms on the Wear who have adopted "joggle" plating—namely, Messrs. Doxford, Sir James Laing, Messrs. Pickersgill, and Messrs. J. L. Thompson & Sons, one firm on the Tyne (Messrs. Armstrong, Whitworth & Co.), and one at Middlesbro' (Messrs. Cragg & Sons). One or two firms abroad have also adopted the system, which is giving every satisfaction wherever it is in use. It is getting on, but not so rapidly as it should do, considering its obvious merits.

A very fine vessel, recently launched from the North Sands yard, is now being fitted out at the Manors Quay Repairing Works, where a large vessel is daily expected to be generally overhauled for reclassing.

Engineering.—Full activity continues to exist at the marine engine works, and in all cases vessels are being fitted with their machinery, the greatest possible dispatch being used in this operation. One or two of the firms have repair contracts to supplement the new work, and at Palmer's Hill establishment (Messrs. John Dickinson & Sons) the department devoted to the manufacture of Dickinson's patent crank shaft is exceptionally busy.

Messrs. J. G. Moore & Co., of the Vulcan Works, Monkwearmouth, are experiencing a large demand for their patent ash-hoist and other specialities, and with their somewhat limited resources, find it difficult to meet the requirements of customers. Changes, however, are imminent, which it is expected will enable them to largely increase their productive power, and the development of the business generally. At the aluminium and brass finishing works of Mr. Wm. Mills, Bonnersfield, Monkwearmouth, business keeps exceedingly brisk, the demand for cabin fittings in aluminium being steadily on the increase. Mills' boat-lowering gear is also in much request, and a good many important orders are now in course of execution.

The Hartlepools.—Shipbuilding is still very brisk at this centre, and in the engineering works sustained activity is the rule. The local steel works are kept busily going, and can with difficulty cope with the current requirements of customers. At the docks business is still somewhat languid, but timber imports will soon become numerous, and it may be expected that coal shipments will also improve.

Stockton.—The shipbuilding yards continue to be well filled with work, and no appearance of a falling off is yet to be ticed at the engineering establishments. Steel works are still pressed with orders, and in the boiler and bridge building works the briskness previously noted is unimpaired. The weather lately has been unpropitious for out-door work, and some enforced idleness of labour has resulted.

Middlesbro'.—It is understood, that in addition to other work of an important kind, Sir Raylton Dixon & Co. have a large vessel in hand for a line of foreign passenger and mail boats. Engineering works keep busy, and the same may be said of boiler works, foundries, &c. At the docks some signs of improving business are apparent.

Consett.—The works of the Consett Company are kept in full activity, and the weekly output of steel plates, bulks, and angles is maintained at its fullest height.

THE MERSEY.

(From our own Correspondent.)

NOTWITHSTANDING the very considerable falling-off in the weight of new work that is just now coming forward in the principal shipbuilding centres, there is no slackening down at all as regards the activity throughout the marine and general engineering industries of this district. The leading tool-making firms throughout Lancashire continue exceedingly busy, and most of them have orders—a large number of which are for shipbuilding and marine requirements—that will keep them fully going, at any rate, over the remainder of the year. New work also still comes forward freely, and—in the tool-making, boiler-making, and stationary and locomotive engine building trades—in more than sufficient quantity to replace contracts as they run out, whilst hydraulic and electrical engineers in all departments are excessively busy.

The briskness of trade is necessarily reflected in the employment returns of the workmen's unions. The Steam Engine Makers' Society, which covers most of the shipbuilding centres, has only one per cent. of its total membership on donation, whilst in the Lancashire district the unemployed list is practically nil. The United Machine Workers' Association reports about 2¼ per cent. on benefit, and in this district a general average of less than 1½ per cent. In Belfast, Gateshead, Leeds, Glasgow, Stockton-on-Tees, Keighley, Halifax, Grantham, Huddersfield, Doncaster, Bradford, Lancaster, Crewe, Gloucester, Hammersmith, Erith, Woolwich, Edinburgh, Wigan, Loughboro', Grimsby, and Attercliffe, there are no members on support.

Since the publication of our last issue Messrs. Laird Bros., of Birkenhead, have received orders from the Admiralty for two more 30-knot torpedo-boat destroyers. Evidently the Government fully appreciate the many successes which the firm have gained in the construction of vessels of the above-named class.

We had the other day an opportunity of inspecting a special duplex vertical milling machine which is being supplied by Messrs. Cunliffe & Croom, of Manchester, to a shipbuilding yard on the Mersey. This machine is of novel design, and, whilst it is capable of dealing with heavy work as one combined machine, it can be used for lighter operations as two separate machines. The bed is 15 ft. long, with four bearing surfaces to support the tables, which are each 10 ft. long by 3 ft. 6 in. wide, the space between the uprights being 8 ft. The tables are each provided with variable self-acting feed motion in either direction, independent of each other, and a quick return by power in both directions. The tables and heads can be run separately as two machines, each with its own independent driving, feed, and reversing motions, or the tables can be coupled by means of an endless chain, which is easily detachable, and one or both heads put in operation. There is a strong cross slide carrying two headstocks, each of which is provided with independent driving and feed motion horizontally, and also quick traverse for adjustment horizontally and vertically by hand. Two portable circular tables are provided, one on each of the long tables, with self-acting feed, for circular milling. The spindles are of hardened steel, revolving in conical bearings adjustable for wear. The tool is of massive design, and constructed to resist heavy cuts, and the gear throughout is machine-cut. The machine is specially designed for use in marine engineering, locomotive, and general engineering workshops. The firm have also in hand several radial drilling tools, with spindles from 5 ft. to 8 ft. radius, with provision on the headstock to set the drill over to work at any angle up to 45 degrees, and automatic lathes for the production of copper ferrules from the tube up to 6 in. diameter.

Messrs. Hulse & Co., Limited, of Salford, who have just added to their establishment new erecting and machine shops, have in hand a number of specially designed heavy machine tools, a noticeable feature of which is the arrangement that has been introduced for driving direct by electric motors, self-contained with the machine. Amongst these are several powerful lathes, on the firm's patent twin-screw principle, in which the motor is placed on the top of the fast headstock, and the variation of speed obtained through positive gear. The speed of the motor is also capable of variation between certain limits, and by this arrangement the gearing of the headstock is greatly simplified. Other special machines include large tools for boring the barrels and hoops of guns, also arranged for driving by variable-speed motors. In these machines there is a central driving headstock for rotating the work, which is mounted on a base plate, and driven by worm and wheel through spur and bevel gearing from the motor. The base plate also carries a boring bed, on which are mounted a sliding carriage and boring bar holder, which have variable self-acting feed motion, and also quick-power traverse motion for rapidly advancing or withdrawing the boring bar, which is operated by an independent motor at the end of the bed. Other tools to be driven by electric motors are a number of patent double-headed drilling machines, for drilling and tapping holes in armour plates. Each machine has a massive slide bed, and the drill spindles can be readily set to any required position, and adjusted by worm and wheel, to drill holes at different angles. The firm have also in hand several massive armour-plate planing machines for dealing with plates up to 10 ft. 6 in. wide, and 18 ft. long. Other work in progress comprises large gun-boring machine and gun-turning lathes, one of the latter being provided with a special apparatus for wire-winding guns up to the largest size. They have also in course of construction complete plants of patent machines for making the Belleville boilers; a four-spindle machine for boring out the oval holes in the headers of water-tube boilers, and five-spindle multiple drilling machines for making the holes in the drums of the "Yarrow" and "Thornycroft" types of water-tube boilers.

Messrs. Hartcliffe & Malkin, of Salford, have brought out a special design of their patent straight full-way valve, with a solid bottom, to prevent leakage. In this valve a special arrangement of angle blocks is introduced, so designed as to compensate for any slight wear of the valve faces.

A new anti-incrustation composition, for steam boilers, is manufactured by Messrs. John S. Morris & Sons, of Manchester, who are introducing it as a special preparation for neutralising the effects of feed waters containing free acids, such as are to be found in the neighbourhood of galvanising works. This composition, which is termed "Pherokalsene," has been used with signal success in several works where the only feed water available contained large quantities of acids, whilst it is also effective in dealing with feed waters containing abundance of silica and iron in combination.

Messrs. W. H. Bailey & Co., Limited, of Salford, have purchased the Ellesmere Foundry, Patricroft, for the purposes of branch works, where they are putting down modern labour-saving plant, and also for the manufacture of Foster patent reducing valves, of which they are making a large number, from ½ in. to 18 in. diameter.

In the iron trade a strong tone prevails generally, and during the past month prices have shown a substantial upward move, both for raw and manufactured material. In pig iron a good steady inquiry comes forward. For local and district brands orders offering have been more than makers can entertain. Lanc maker. hav. withdrawn quotations and district brandshave advanced about 2s. a ton. No. 3 foundry Lincs. is now quoted 55s. 6d. net; and Derbyshire, 57s. net delivered Manchester; with forge qualities, delivered Warrington, about 53s. 8d. net cash for Lincolnshire. In outside brands prices during the month have been rather irregular, but towards the close they have hardened up about 2s. per ton. Delivered by rail Manchester foundry Middlesbrough 59s. 4d. to 59s. 10d. net cash, with Scotch iron, at the Manchester docks, about 61s. to 62s. 6d., and ordinary American foundry brands about 57s. to 57s. 6d. net cash.

In the finished iron trade a brisk tone characterises business, and there has been an all-round advance in prices. Official list rates for bars have been raised 5s. per ton, £7 being now the minimum for Lancashire, and £7 5s. for North Staffordshire qualities, with a lurther advance asked on actual business. Sheets are also stronger, and now quoted about £8 2s. 6d. to £8 5s, List rates for hoops have been advanced 5s. per ton, which now brings them up to £7 5s. for random and £7 10s. for special cut lengths delivered Manchester district, and 2s. 6d. less for shipment. Merchants have put up their stock prices for all descriptions of manufactured iron and steel 10s. per ton.

Nut and bolt makers have advanced their minimum list rates 10s. per ton.

In the steel trade there is no material change to report, and with the exception of some irregularity in quotations for boiler plates, prices are generally very firm at full late rates. No. 3 foundry hematites range from 70s. to 72s. less 2½; billets, £5 2s. 6d. net; bars, £7 10s. to £7 15s.; common plates, £7 15s. to £7 17s. 6d.; boiler plates have been sold as low as £8 10s., but the general quotation is £8 15s., delivered Manchester district.

Business comes forward freely in the metal market, which is quickly recovering from the downward tendency reported last month. List rates for brazed brass tubes, brass wire and rolled metals, have been put up ½d. per lb., and copper wire 1¼d., and quotations for delivery in the Manchester district are now as under: solid-drawn brass boiler tubes 8¾d.; solid-drawn brass surface condenser tubes, 10¼d.; solid-drawn copper tubes, 11d.; brazed copper gas and steam tubes, 10¾d.; brazed brass tubes, 10d.; common rolledb rass, 8¼d.; common brass wire, 8½d.; copper wire, 10¼d. per lb.

The timber trade is rather quiet. The arrivals however, generally have been only moderate, and deliveries fairly satisfactory. Stocks as a rule are not too large, and values steady. For teak squares, with light arrivals, and an increased enquiry, prices are firm, and stocks moderate. Planks have arrived freely, but there is a good demand, and stocks are not excessive. The consumption of greenheart has been small, and stocks are sufficient, with prices unaltered.

In the coal trade all descriptions are in brisk request, and, in the lower sorts especially, the demand is greatly in excess of the output. Business in the better qualities of round coal is exceptionally good for the time of the year, and prices are exceedingly firm at the full list quotations. The activity throughout the iron trade and other manufacturing industries is keeping up a large demand for the lower qualities of round coal suitable for steam and forge purposes. In many cases collieries, as already mentioned, are short of supplies to provide for the deliveries required by their customers, and prices tend to harden, 9s. being readily obtainable for good qualities at the pit's mouth. With regard to the gas coal contracts for the ensuing season, a strong combination of coal owners has been formed with the object of keeping up prices, and they are holding out for a general advance of 1s. 6d. to 2s. per ton over last year's rates. On the locomotive fuel contracts an advance of 1s. 6d. is also being held out for, and it is reported that the contracts have been practically settled on this basis. Engine fuel is in brisk demand, with supplies short and new business difficult to place. Prices are firm at the recent advance, common sorts averaging 5s. 3d. to 5s. 6d.; medium 5s. 9d. to 6s.; best 6s. 6d. to 6s. 9d. at the pit.

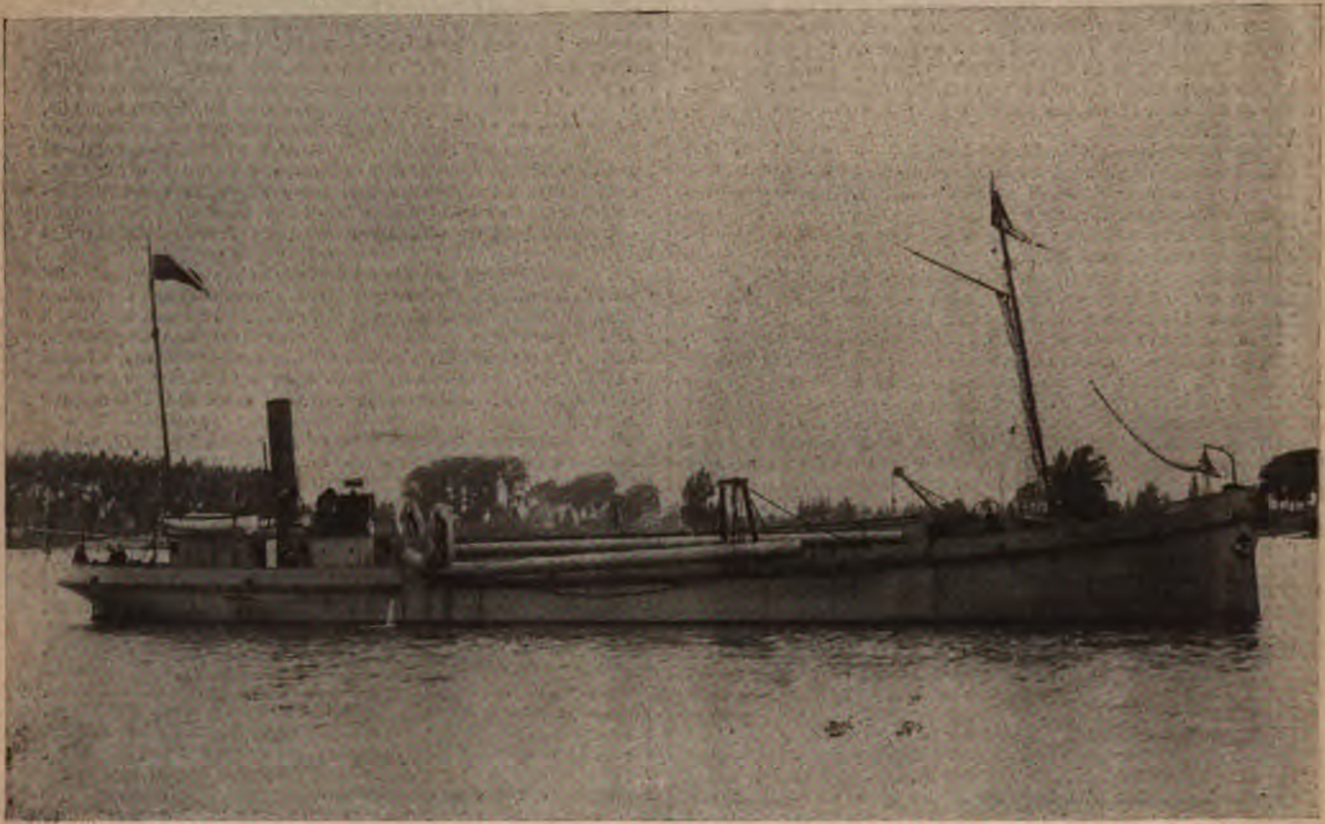
Shipping is fairly active, with ordinary steam coal averaging about 9s. 6d. to 9s. 9d. at the Garston Docks; 10s. High Level, Liverpool; and 10s. 3d. to 10s. 6d. Partington tips, Manchester Ship Canal.

THAMES.

(*From our own Correspondent.*)

R. & H. Green & Co.—There is a fair amount of work at the Blackwall yard. The Great Eastern Railway have sent their two paddle steamers there to get a general overhaul, the engines for the same undergoing similar treatment at John Penn & Sons'. Then on the stocks six steel barges are being built, and there is also a large tank under construction for the London and India Joint Stock Company.

The Thames Iron Works, Limited.—The two first-class battleships the *Duncan*, and the *Cornwallis*, are now fairly under way, and they are expected to keep the place going for at least three years. Their dimensions are 405 ft. in length, 75 ft. 6 in. beam, and 26 ft. 6 in. draught. They are of 14,000 tons, and 18,000 I.H.P. Their armament consists of four 12-in. breech-loading guns, two barbettes, twelve 6-in. quick-firing, in casemates, twelve 12-pounders, six 3-pounders, and four torpedo tubes. The engines are triple-expansion, and they are to be fitted with Belleville boilers. The Agent-General of the Cape of Good Hope has ordered a pontoon for the St. John River, and three barges of steel and iron for the same. There are also on the stocks ten barges for private firms. As mentioned in the speech made by Mr. Hills not long ago, the Thames, Limited, with their eight-hour day system, have obtained all the work for the National Lifeboat Institution, and at the present time some five boats are being built.



THE DREDGER "TITUS EDRIGEVITCH."

John Stewart & Son, Limited.—The dredger *Titus Edrigevitch* has steamed out to Archangel by her own power; and at the pumping trials the hopper was filled with 1,000 tons of sand in twenty-five minutes, which was well under the contract time, and the officials of the Russian Government are pleased with the results. The dredger is 183 ft. 10 in. in length, 32 ft. 9 in. beam, and 13 ft. 10 in. depth, moulded. It has a capacity for 500 metrical tons, and when the draught is normal, 11 ft. 11 in., the speed is 8 knots an hour. There are ten bulkheads extending to the upper deck. There are three ways of discharging: first into the hopper wells, second into barges, and third through tubes on to the shore. The crew's places are heated with steam. The dredger is also fitted with the electric light, and there is a search-light projector. The dredging is performed by means of two centrifugal pumps, and these are driven from the fore ends of the shafts of the propelling engines by clutch gearing; the suction is jointed to the ship's side, and arranged that it can be raised and placed on deck.

The General Engineering and Boiler Company have under construction the compressors for the *Drake*, and also the refrigerating machinery of the Japanese cruiser. The air compressors of the *Irresistible* are also being made, and both the refrigerating machinery and the air compressors of the *Implacable* are under construction.

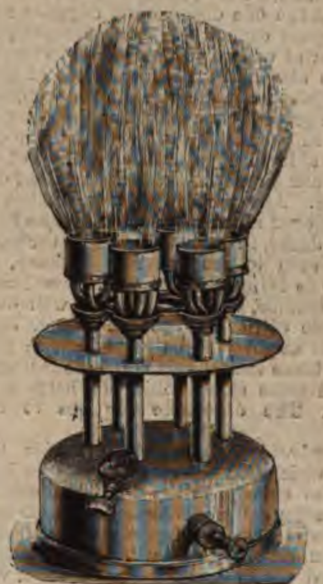
Messrs. Maudslay, Sons & Field, Limited have had interesting notices in respect to their Belleville boilers in the ordinary Press. The *Daily Mail* has been devoting itself to the burst tubes of the *Terrible*, and the *Pall Mall Gazette* has pointed out a few things on the Parliamentary position. Says the *Pall Mall Gazette*: "The matter is one of profound importance to the country, for immense sums have already been spent upon these contrivances, and more is about to be spent. Moreover, the boiler cannot be considered as apart from the ship; and, if the cost of the vessels affected be taken into consideration, the figures run to many millions. Under these circumstances, the statement made by the First Lord is very grave." After the policy of the Admiralty was stated by Sir William White and Sir John Durston to be the fitting of the fleet throughout with water-tube boilers, the First Lord says: "The whole question of the value of water-tube boilers is still under consideration;

the Admiralty engineers still have 'open minds'; the expression of a categorical opinion at this stage would be premature." Says the *Pall Mall*: "Experiments should be made with one or two ships at the utmost, and not until those experiments have been conducted with absolute success, and over a long period, should the nation be committed to the expenditure of millions. Whether the Belleville boilers be good or bad remains to be proved; so much may readily be conceded to the Admiralty. But to claim the benefit of the admission is to plead guilty to a grave error of judgment." But the *Pall Mall* gives itself away on the question of solid-drawn or welded tubes. "Parliament," says the *Pall Mall Gazette*, "was given to understand that the tubes of the *Powerful* and *Terrible* were the same as those of the *Sharpshooter's* boilers. The tubes of the *Sharpshooter* were solid-drawn; those in cruisers were welded. They were not the same, and the recent explosion has shown that the discrepancy was most material." There is one question the *Pall Mall* might answer for us. Did the tubes of the boilers of the *Terrible* explode at a seam of the welded tube?

This firm has also fitted the main engines of the new cruiser *Spartiate*. They are to be of the same dimensions as the engines of the *Diadem*, but instead of 16,500 H.P., they are to develop 18,000 I.H.P. The boilers are not to be larger, but have to give increased evaporation from increased heating surface. These engines are of the four-cylinder triple-expansion type, the cylinders being set in the following order—low, high, intermediate, and low pressure reckoning from forward; their diameters are 64 in., 34 in., 55½ in. and 64 in., stroke 4 ft. The cylinders are steam-jacketed, their working barrels being made of close-grained cast iron. The valves of the high and intermediate pressure cylinders are of the piston type, while the double-posted flat valves are fitted to the low-pressure cylinders. All the valves are fitted to double eccentric and twin-bar links. The cylinders are supported on four cast-iron double-legged columns, at the back of the engines, these are bolted together in pairs at their feet, the front supporting columns being of forged steel turned. All of them, says the *Engineer*—at front and back—being carried by and firmly bolted to the cast-steel main bearing brackets, which are connected together at their ends by girders, and the whole firmly secured to the engine-seatings worked up from the ship's frames. The crank shafts of the engines are of steel, the dimensions of the crank-pins being 1 ft. 7 in. diameter and 1 ft. 9 in. long, the crank shaft bearings each 1 ft. 5½ in. and 11 in. long. The high-pressure crank is at right angles to the intermediate-pressure crank, and low-pressure crank (aft) at right angles to low-pressure crank (forward). The propeller shaft is 17½ in. diameter, and the turret shaft, 16¼ in. diameter. They are all hollow, with a 9 in. diameter through them. The thrust blocks have collars of the horse-shoe type lined with white metal. Each set of engines has an air pump, 2 ft. 6 in. diameter and 27 in. stroke, driven off the high-pressure piston rod crosshead. The condenser has 9,500 square feet of cooling surface, the water for cooling being supplied by centrifugal pumps 3 ft. 9 in. diameter, driven by independent engines. The screw propellers are 17 ft. diameter, and the pitch ranges from 19 ft. to 22 ft. There are thirty water-tube boilers, each fitted with an economiser. They are placed in groups in four compartments, or boiler-rooms, three containing eight boilers each, and the forward compartment containing six boilers. Each boiler has one fire-grate with three fire doors to it. They are placed in a fore and aft direction, thus preventing the roll or list of the ship affecting the level of the water within them. The tubes of the boilers are 4½ in. external diameter, and in the economisers 2¾ in. diameter. The boiler tubes are ⅜ in. thick, while in the economisers they are ·16 in. They are steel, and solid drawn. They are worked at a pressure of 300 lbs., which is reduced at the engines to 250 lbs. The temperature at which the feed leaves the economiser is from 240 deg. to 250 deg. Fahr. The grate surface is 1,390 square feet, and the total heating surface, in all the boilers, is 47,282 square feet. It is estimated that the engines will make 120 revolutions per minute and give a speed to the vessel of 21 knots per hour. The coal bunker capacity is 1,000 tons, but an extra 900 tons can be taken. About sixty auxiliary engines are being made by Messrs. Maudslay, Sons & Field. The firm have the following orders on hand, April 24th, 1899:—1 set of twin-screw engines for H.M. battleship *Irresistible*, 15,000 I.H.P.; 1 set of twin-screw engines for H.M. battleship *Venerable*, 15,000 I.H.P.; the above are in a state of erection in the shops. 1 set of twin-screw engines for H.M. first-class cruiser *Spartiate*, 18,000 I.H.P.; being erected on board at Pembroke, now approaching completion. 1 set of twin-screw engines for H.M. battleship *Albion*, 13,500 I.H.P.; being erected on board at Victoria Docks, now approaching completion. 1 set of twin-screw engines for H.M. second-class cruiser *Gladiator*, 10,000 I.H.P. Trials successfully completed in February last. Mean speed attained 19·1 knots per hour (8 hours' trial). All the above vessels are fitted with Belleville boilers; all but H.M.S. *Gladiator* with economisers.

The bursting of the tubes in the Belleville boilers of H.M.S. *Terrible* cannot fail to be of interest to Messrs. Maudslay, Sons & Field. Five tubes burst in all, but the last burst was the worst, and this was fairly high up in the flattened spiral. The tubes were lap-welded, and had undergone a test of 1,000 lbs. to the square inch, and the boiler had been tested to 360 lbs. to the square inch. Charles Warburton, in his evidence, said it was usually the fourth or sixth tube up from the fire which burst. The bursting took place when the furnace doors were opened.

Messrs. Mceller & Condrup's have on view at their show-rooms, 78, Fore Street, E.C., a new and simple burner for industrial purposes, such as steam raisng. The one shown in the figure has six burners, but they are made with from one to twelve burners. The lamp oil is contained in the cylindrical brass vessel. To start the burner, methylated spirit is poured into little saucers round it. When lighted, it heats up sufficiently to vaporise the oil, and this ignites at a little hole at the top of the main vertical tube. It maintains the main body of the burner at the temperature necessary, and the oil is driven up by pumping it by means of the little pump shown by the knob at the side. There is also in the filling plug a little air-valve C. The flame is put out by reducing the pressure in the cylinder by opening the air-valve.



Mr. C. H. Bryant, of Chiswick, has invented a new oil engine which has been fitted into a launch, and successfully tried at Chiswick. The dimensions of the launch are 40 ft. long by 6 ft. 6 in. broad, and draught 30 in. The cylinders of the engine are 4 in. diameter by 10 in. stroke, and they run at 300 revolutions per minute, the speed of the launch at this rate being nine miles an hour. It is claimed that with this engine there is a continuous explosion and expansion to the end of the stroke. To start the engine, a blow lamp is put outside of the mixing chamber which heats it, and when heated the engine can be started. The blow lamp is taken away, and it is then self-firing. The exhaust finishes with a flame, and there is no deposit. The covered-in space for the engines is 28 in. by 38 in. The engine takes the place of a compound steam-engine of 23 I.H.P., which would have occupied the space of 13 ft. by 6 ft.

BELFAST.

(From our own Correspondent.)

THE shipbuilding and engineering industries continue as brisk as ever, and during the past month negotiations for advances in wages have been going on, resulting in certain classes of workmen obtaining the rise in the two principal yards here. Platers' helpers receiving an advance of 2½ per cent., and there is also an advance of 2½ per cent. on piece-work rates, whilst iron sorters, stagers, and labourers in both shipyards and engine works have been advanced sixpence per week. At the present time riveters, for certain classes of heavy work in the yards, cannot be got at any money, and this will undoubtedly impair the output of the tonnage of the port.

But one launch has taken place during the past month, and this was the *Ping Suey*, from the north yard of Messrs. Workman, Clark & Co., Limited. She has been especially built for the Oriental trade of the China Mutual Steam Navigation Co., Limited, of London.

This same firm have also despatched another vessel during the month, this being the s.s. *Yangtsze*, which, after a most successful trial trip, left Belfast Lough for the Clyde, there to load cargo for a Chinese port.

Messrs. Workman, Clarke & Co., Limited, have at present either eight or nine large steamers on hand, with an aggregate tonnage of between 60,000 to 70,000 tons. But we continue to hear complaints about the scarcity and irregular attendance of certain classes of workmen. This is very detrimental to the work of shipbuilding, as the one department depends so much on the other that progress cannot be made as rapidly as wished, and the completion of vessels is accordingly very much delayed. This firm have also had an extensive lot of shipbuilding and engineering repairs in hand since the year commenced; indeed, they are at the present time enlarging their shops and augmenting their tools in the repairing department, in order that they may be more able to cope with this class of work; but the greatest drawback here just now is for want of graving dock accommodation. As a proof of this, during the past week men have been employed night and day on repairs in more than one of the graving docks, in order to facilitate the relays of steamers waiting their turn to get in. For instance, at the present moment there is lying adjacent to Messrs. Harland & Wolff's yard the s.s. *Oceanic*, which is getting well on towards completion; outside of her is the s.s. *China*, belonging to the P. & O. Co. It might just be remarked, in passing, that the comparison of these two vessels, when seen alongside, makes the *China* look like some small collier discharging coals on board the leviathan. The difference requires to be seen to be believed.

The s.s. *Cambronian* at present occupies the Alexandria graving dock, which was but recently vacated by the *Germanic*. The *Cambronian* belongs to the Dominion Line, and is being fitted with superior cabin accommodation; and after the various saloons, staterooms, and smoke-rooms are finished, she will be placed on dated passenger sailings. The s.s. *Germanic* is being pushed forward with all possible speed, and will ere long be again on her regular passenger trade between Liverpool and New York. It is stated that it took £6,400 to raise this vessel from the bed of the Hudson River. The s.s. *China* is intended to occupy the dock next in turn. It is expected she will take a long time to repair, but no one can yet tell what her bottom will be like after her prolonged seat on the rocks at Perim for several months. But the fact that she made the passage home under her own steam, and only accompanied by two tug steamers, in case of accident, speaks volumes for the strong construction of her hull; but what with costs of salvage operations, towage, &c., and the cost of her repairs here, it would be interesting to know the amount of the bill this ship will cost.

Messrs. Harland & Wolff, Limited, have also the *Afric*, of the White Star Line, on hand. This steamer has returned to this port in order to be fitted with large and improved refrigerating machinery, which could not be got forward in time to be placed in the ship when she was built by the firm. She is also getting some minor alterations and overhauls, and will soon be at her station again. Alongside of her is the s.s. *Medic*, a sister ship, also being fitted out. Altogether, docks and wharfs here are crowded with very large steamers under repair and fitting out. We understand, too, that Messrs. Harland & Wolff have two steamers under construction for the Union Co., but these, as well as others, have been sadly delayed, owing, as already mentioned, to the want of rivetters; besides, as explained in the past number, the plates, rivets, &c., of these large vessels cannot be manipulated by hand, and it is this heavy work that the men so much object to.

A great falling off in enquiries for steamers is reported from various shipbuilding centres, and it is generally thought that a reaction has already set in; but we sincerely hope there is no foundation for these rumours.

Local land-engine makers and foundries are still well employed; but, as there is a great depression in the other principal trades of this city, the town is almost dependent on the shipbuilding industry.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—There is very great activity observable in the shipbuilding industry of this town, and since the Easter holidays there has been a further increase in the number of men employed, and a gradual expansion in the several departments of the concern of Vickers, Sons & Maxim at the Naval Construction Works. No new orders have been booked except one for the Admiralty in the form of one of the twelve 30-knot torpedo-boat destroyers to be built by private builders. Possibly Vickers' would have secured more of this type of order had it not been that their hands are already very full with Admiralty work of the largest and highest class. All the torpedo-boat destroyers built here have turned out very satisfactorily, and the more so has this been the case since Vickers' took over the yard and supplied the ships with their special steel for engineering and other work, which has shown itself so very trustworthy in all cases where good, reliable metal was required for special purposes. The demand for ordinary shipbuilding tonnage is comparatively easy, probably on account of the very much higher range of prices now ruling for shipping making new boats almost a prohibitive luxury, except in cases where absolute necessity steps in, and a good market is open in heavy freights for costly boats. Consequently more attention is devoted in the Barrow Yard at present to Admiralty work generally, and in this respect Messrs. Vickers have their hands well filled. The only commercial tonnage jobs Messrs. Vickers have in hand at present are the second of two West African Steam Navigation Co.'s steamers, the *Bornu*, which is to be launched on the 9th of May. Her sister ship, the *Sokoto*, left Barrow at the beginning of April and had her trial trip between Barrow and Liverpool and passed through it very creditably. The engines were worked by degrees up to full speed, in a heavy sea, and the speed of the steamer was much in excess of her specified requirements. The owners are very pleased with the ship. Certainly new engines never started under more satisfactory conditions. The second commercial order in hand is that of the Pacific Steam Navigation Co.'s steamer *Ortono*, which is to be launched in June, and the third commercial order in hand is that for the supply of a Clan Line steamer, so that at the present rate Messrs. Vickers will soon be rid of all commercial tonnage. They intend to pay great attention to Admiralty work of every class, and are extending their yard considerably in area, and increasing its mechanical equipment generally, in order to do not only a much greater volume of work, but to turn the same out with the greatest possible expedition. The shipbuilding yard is being nearly doubled in size, and, when this addition is put to the present yard, and fully equipped with mechanical appliances, it will be possible for the firm to undertake every variety and every size of work. The old yard will naturally be devoted to the building of heavy ships, and the new part to the building of lighter craft, because in the case of the latter the launching area is not so wide; but that could be modified by building the vessels at a different angle in the yard, as is done in many cases on the Clyde and elsewhere where the construction of big ships is undertaken in small yards. The launch of H.M.S. *Vengeance* has been definitely fixed for July 25th next, and will doubtless be the occasion of a very big function, seeing this is the first battleship ever built in the history of the shipbuilding trade by one firm absolutely out of their own resources; for Messrs. Vickers are not only building this ship, but providing it with armour-plates, guns, gun-mountings, ammunition, engines, and every appliance required for its full fighting equipment at sea. The *Vengeance* at present represents something like 7,000 tons deadweight, but she lies on very solid and well

nd, and her successful launching can very easily be
n at so great a deadweight. Much progress is being
the first-class cruisers *Hogue*, *Euryalus*, and *King*
rs. Vickers are amongst the firms who have tendered
new cruisers, first-class, required by the Admiralty
builders this year. The new Japanese battleship
Barrow is to be named the *Mikasa*, and not *Nikasa*,
y reported. She is getting well up in frame, and
ery ponderous ship, being 15,000 tons deadweight
Much satisfaction and credit is felt in Barrow at the
successful official trial trips of the first-class cruiser
protected, built at Barrow. She has beaten all
o economic coal consumption in the Admiralty's
and it is noteworthy that, while she fulfilled all con-
engines and boilers, which worked faultlessly and
tch, had much reserve of power undeveloped. The
the greater to the Barrow firm because the *Amphi-*
ing the records, beat her sister ship the *Niobe*, built
hich previously held the record. Very great credit
r. Adamson, the general manager of the Barrow
r. McKechnie, the engineering manager, for the very
btained. They have been heartily congratulated
building and engineering world generally, and they
ainly a very high tribute of honour.

ne for building a thousand houses on Walney Island
of the extra workmen being employed at the Naval
Works is practically realised so far as the purchase of
y land, the plan of the houses and streets, and the
itals are concerned ; and an early start is to be made
as there is a pressing need for house accommoda-
gh several hundreds of new houses are already in
ilding in other parts of the town.

ally believed that the Bill the Furness Railway Co.
in Parliament this year will pass through without
One of its clauses will enable the Furness Railway
e a new lock at the Ramsden Dock, Barrow, by means
sels of 30 ft. draught and 100 ft. wide can enter the
s extra accommodation is essential in the interests
ilding trade, and especially so as such a heavy class
now being built at Barrow ; and, seeing that the new
eing constructed for use as a graving dock, it will
advantage to shipbuilders, not only for the vessels
but in dealing with repair orders to large ships,
ion for which is greatly needed on the West Coast

e month the Furness Shipbuilding yard at Barrow,
ught under the hammer, and the shipway and all
ery has been disposed of. This is a very suitable
ide the graving dock shipyard, for the building of
s of vessels, and it is on the cards that this area
her be utilised as a private yard or be swallowed up
concern.

is being directed to Barrow as a suitable *locale* for
tary dockyard for the Admiralty, particularly in
its suitability as a repairing place for all classes of
There is a big dock of 200 acres, which, if dredged,
tremendous number of ships, and there is alongside
the old Vulcan Steel Works, which could readily be
as an engineering repair shop in connection with a
Barrow is essentially cut out as a model dockyard,
commodation at disposal could be acquired for,
peaking, an old song. There is at present a cry that
ds are too busy to undertake the repair work
o so large and so growing a fleet : Barrow offers
or the supply of this deficiency which ought to be

Caird.—The death occurred in the middle of
David Caird, at his London residence in West
at the age of 53 years. He was for several years a
t Barrow, at the Graving Dock shipyard, and there,
with various partners, built several small steamers.
rs he devoted himself to contracting work, and
gaged in the direction of the Kerosine Oil Co.,
Steel Plant Co., Limited, the Furness Foundry
ring Works, at Barrow, and in many other
ncerns. At the time of his death he was engaged
er things in the building of over 100 houses on Old
nd.

en.—A wail comes from Whitehaven every now
ut the restarting of the old shipyard at this place.
out that a place like Londonderry can resuscitate
ling industry by reopening its yard after being closed for six years, and the question is asked, Why should not Whitehaven do likewise? There is no reason in the world, except the want of local enterprise. Once that is awakened, and the Whitehavians have the courage to engage a good, practical manager, in whom they can place full confidence, and allow him full scope at his work, the chances are that Whitehaven will be found to be as good a place for shipbuilding as any other.

Shipbuilding Material.—The demand for steel shipbuilding material is very briskly maintained, and the orders offering to makers in this district show an increase in volume; indeed, some shipbuilders have very pressing requirements, and are anxious to ensure very full deliveries at the soonest possible date. It is found necessary in the present congested state of the market to send out specifications for material under delivery contract much earlier than some time ago, in order to ensure attention in time. Both the heavy and light plate mills are very busily employed, and many more orders could be obtained if makers could undertake them. Arrangements are, however, in progress for the augmentation of the output of plates by the erection of additional Siemen-Martin's furnaces, and the provision of more powerful stabbing mills, so that the mills can be readily fed with materials, and their output thereby increased. Prices are very steady and firm at £7 2s. 6d. for heavy steel plates, and £8 2s. 6d. for light plates. It is contemplated to put an angle mill at the Barrow Works by taking out an old rail mill. This would be a very wise step, because Barrow is splendidly situated for a large and profitable business in angles, and in every class of shipbuilding material, and it is felt that the more attention that is shown to Siemen-Martin's steel manufacture here, and the less there is shown to Bessemer, the better will it be for makers and for the trade of the district generally. There is a brisk and a growing business doing in heavy and light steel castings for shipbuilding and engineering purposes, and the recent enlargement of this department at the Barrow Steel Works has been more than justified already.

West Cumberland.—The shipbuilding trade in the West Cumberland district remains very busy, and builders have on hand a very fair number of orders. Particularly so is this the fact at the yard of Williamson & Son at Workington, in which a large number of small craft are built, and where there is never any scarcity of work. The trade at Maryport is not so brisk, but that is not on account of any weakness in the market or any scarcity of orders. Latterly, Messrs. Ritson & Sons have kept their yard fairly low down in orders, although they have never suspended operations. It is expected, however, now that there is so much life in shipbuilding, a more active trade will be undertaken at Maryport in the building of small craft.

Hematites. — The hematite pig-iron trade is very busily employed, and there are indications that a much more active market will soon be experienced, as America is likely to become a large customer for North-West hematite metal. The orders held are numerous, and with a slight improvement in the demand a famine would arise. Warrants have been temporarily depressed by reason of bearing operations which have failed. They are now quoted at 61s. per ton net cash sellers, 60s. 11d. buyers. Makers quote 60s. to 61s. per ton for mixed Bessemer numbers. Stocks of metal have slightly increased during the month, and now stand at 221,669 tons, or about 45,690 tons more than at Christmas last.

Shipping.—The shipping trade this year has not been as briskly employed as in the previous year, and the tonnage of exports of metal shows a falling off. The aggregate for this year so far has reached 133,426 tons of pig-iron and 143,772 tons of steel, as compared with 150,178 tons of pig-iron and 164,280 tons of steel, showing a decrease of 16,752 tons of pig-iron and 20,506 tons of steel. Freights are fairly well maintained, and it is probable that shipping will soon be busier, as heavy foreign cargoes are expected to be cleared.

The Akebono (Dawn), the third of six torpedo boat destroyers being constructed for the Imperial Japanese Government by Messrs. Yarrow & Co., Limited, was successfully launched at the works of the builders at Poplar, on Tuesday, April 25th, in the presence of Admiral O. Matsunaga, Inspector-General for the Japanese Navy, Constructor-Commander Kondo, Constructor Captain Kurobe, and other Japanese officials. The guaranteed speed is 31 knots on a three hours' run, carrying 35 tons.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Scotsman.—On March 10th there was launched at South Shields, for Messrs T. Gray & Co., of Hull, a steel steam ketch of about 105 tons, named the *Scotsman*.

Yomoana.—On March 11th there was launched at Sunderland for Messrs. Tyser & Co., of London, a steel schooner-rigged steamer, of about 5,648 tons, named the *Yomoana*.

Cleopatra.—On March 13th there was launched at Hull for the Hellyer's Steam Fishing Co., Limited, of Hull, an iron steam ketch, of about 193 tons, named the *Cleopatra*.

King Alfred.—On March 13th there was launched at Grimsby, for the Monarch Steam Fishing Co:, Limited, of Grimsby, a steel steam yawl, of about 159 tons, named the *King Alfred*.

Kathleen.—On March 16th there was launched at Selby for the Central Steam Fishing Co., Limited, of Grimsby, a steel steam ketch, named the *Kathleen*.

Beatrice.—On March 23rd Messrs. D. Banks & Co. launched at Plymouth the lighter, *Beatrice*, 60 ft. long by 20 ft beam and 8 ft. depth of hold, for the Queen Anne's Battery Trading Co., timber importers and merchants.

Mont Blanc.—On Saturday, March 25th, Sir Raylton Dixon & Co., Limited, launched from Cleveland Dockyards, Middlesbro', a fine steel screw steamer built to the order of the Societe Generale de Transports Maritimes a Vapeur, of Marseilles. She is built to Lloyd's highest class spar-deck rule, and has a deadweight carrying capacity of about 4,650 tons, on a light draught of water. Her principal dimensions are:—Length, 331 ft.; beam, extreme, 44 ft. 8 in.; depth, moulded, 25 ft. 9 in. The spar and main decks are of steel with poop, bridge, and forecastle decks of pitch pine, five watertight bulkheads, cellular double-bottom for water ballast, deep framing, &c., with officers' accommodation in houses on bridge deck. She will be fitted with triple-expansion engines built by the North-Eastern Marine Engineering Co., Limited, Wallsend, having cylinders 23 in., 36½ in., 62 in. by 42 in., with two large single-ended boilers working at 180 lbs. pressure. On leaving the ways she was gracefully named *Mont Blanc* by Miss Alice Cohan, daughter of Mr. E. A. Cohan, of Liverpool.

Gadsby.—On March 27th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 336 ft. 6 in.; breadth, extreme, 46 ft. 6 in.; depth, moulded, 27 ft. 3 in. The steamer has been built to the order of Messrs. R. Ropner & Co., West Hartlepool, and is of the three-decked rule, with full poop, very long bridge, and topgallant forecastle. The saloon and cabins for captain and officers will be fitted up in the poop, the accommodation for engineers in iron houses on the bridge deck, and the crew in the forecastle as usual. She has double bottom on the cellular principle for water ballast, and will carry about 6,000 tons on Lloyd's summer freeboard, on a light draught of water. She will have all the most recent appliances for the expeditions and economical loading and unloading of cargoes, has direct steam windlass, steam-steering gear amidships, with powerful screw gear aft, six large steam winches, to which steam is supplied by two large vertical donkey boilers, stockless anchors, &c. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, having cylinders 24 in., 40 in., 66 in. by 45 in. stroke. The christening ceremony was gracefully performed by Miss Walker, of Owton Fence House, Greatham, who gave her the name of *Gadsby*.

Highgate.—On March 27th Messrs. S. P. Austin & Son, Limited, launched at Sunderland, to the order of Messrs. William Cory & Son, Limited, of London, the steel screw steamer *Highgate*. The dimensions are:—Length, 268 ft.; breadth, 37 ft. 7 in.; and depth, 19 ft. 9 in.; and she will be classed 100 A1 in Lloyd's register, the deadweight carrying capacity being about 2,600 tons. The machinery will be supplied by Messrs. George Clark, Limited, and is of the tri-compound type.

Algoma and **Andes.**—On March 28th there was launched at North Shields, for Messrs. J. & G. Alward, Limited, of Grimsby, two iron steam ketches, of about 156 tons gross each, named the *Algoma and Andes*.

Britomart, H.M.S.—On March 28th Messrs. W. H. Potter Sons launched at Liverpool the second of two shallow-draugh twin-screw, teak-sheathed steel gun-boats which have been buil to the order of the British Government for use in the Africa rivers. The vessel, which is named the *Britomart*, is a siste ship to the *Bramble*, and is one of four of the *Thistle* class, tw being built by Messrs Potter, the other two on the Clyde. Th dimensions of the *Britomart* are as follow:—Length betwee perpendiculars, 180 ft.; length over all, 187 ft. 6 in.; beam extreme over wood sheathing, 33 ft. The machinery consist of two sets of triple-expansion, three-crank engines, and tw Yarrow water-tube boilers. This will be the last vessel built Liverpool, as Potter's yard has been acquired by the Doc Board for the extension of Queen's Dock.

Anglo-Australian.—On March 28th this large and handsomely modelled steel screw steamer, built for Australian trad to the order of the Nitrate Producers' Steamship Co., Limited, London, of which Messrs. Lawther, Latta & Co. are th managers, was launched from the works of Messrs. Shor Brothers, of Sunderland. This vessel, which is constructed steel throughout, has been built under special survey to th highest class in Lloyd's register, and is of the following dimensions:—Length, 370 ft.; breadth, 48 ft.; and depth, moulded, 30 ft. with a large deadweight and carrying capacity. The erection on deck consist of full poop, long bridge amidships, and topgallant forecastle. Large and commodious deck houses ar fitted on the bridge deck for the accommodation of captain officers, and engineers, with large and handsomely fitte saloon, the panelling being in polished hardwoods tastefull arranged. On the flying bridge deck, a large and commodiou teak wheel and chart house is fitted, the steam-steering gear i fitted in the engine-room with controlling rods to wheel hous and flying bridge. The crew are berthed in the forecastle which is divided by a passage way, and further divided fo petty officers, &c. The double bottom is constructed on th cellular system subdivided into trimming tanks, the peaks als being fitted for water ballast. The holds are four in number which for rapid loading and discharging have been fitted wit eight powerful steam winches, steam for which is supplied by large multitubular donkey boiler placed in the stokehold. In addition, the vessel is fitted with all the newest appliances fo despatch and the economical handling of cargoes. A complet electric light installation is also fitted. On leaving the way the vessel was named *Anglo-Australian*, the ceremony bein performed by Miss Short, of Ashbrooke Hall, who was handed very handsome present by one of the directors on behalf of th company. The vessel is to be fitted with triple-expansio engines by Messrs. George Clark, Limited, of Sunderland having cylinders 26 in., 42 in., 70 in. diameter, with a stroke 48 in., and two large steel boilers of 180 lbs. working pressure fitted with Howden's system of forced draught.

Loch Linthrathen.—On Tuesday, March 28th, there wa launched from the yard of the Tyne Iron Shipbuilding Co Limited, of Willington Quay-on-Tyne, a steel screw steame built to the order of the Dundee Loch Line Steam Shippin Co., Limited, of Dundee, and of the following dimensions:—Length, 320 ft.; breadth, 48 ft.; depth, 23 ft. 6 in., and class 100 A1 at Lloyd's on the single-decked rule. This vess has water ballast fitted right fore and aft on the cellula system, and is also fitted with all modern improvements for th rapid loading and discharging of cargo, including six doubl cylindered steam winches, direct-acting steam windlass, larg donkey boiler, steam-steering gear by Messrs. Alley MacLellan, Limited, and Hasties' screw gear aft. The engines which are to be supplied by the North-Eastern Marin Engineering Co., Limited, of Wallsend-on-Tyne, are of th triple-expansion type, having cylinders 23½ in., 39 in., and 64 in by 42 in. stroke, and working at a pressure of 160 lbs. O leaving the ways the vessel was named the *Loch Linthrath* by Mrs. Ritchie of Dundee.

West Point.—On March 28th there was launched from th shipyard of Messrs. Robert Stephenson & Co., Limited, a larg steel screw steamer for the Norfolk & North American Stea Shipping Co., Limited, managed by Messrs. Simpson, Spence Young, of London and Newcastle-on-Tyne. The vessel is the following dimensions:—375 ft. between perpendiculars 50 ft. breadth extreme by 30 ft. 1 in. depth, moulded. The ves is built on the three-deck rule to Lloyd's highest class, havi a long bridge, poop, and forecastle. The framing is on the de girder frame system in lieu of hold beams, so as to facilitate stowing of cargo; the main deck is of steel, the upper deck and the bridge and forecastle decks are of iron. There is a cellular double bottom fore and aft for water ballast, a deep ballast tank abaft engine room bulkhead, extending from floors to main deck, also water ballast in after peak. The arrangements for the rapid loading and discharging of cargo are very complete, there being nine powerful steam winches to work the cargo. The vessel is also provided with a powerful steam windlass, a steam steering gear, and a steam warping capstan aft. Under the long bridge there are fittings provided for the carriage of cattle. Accommodation is provided for captain, officers, engineers, and passengers on top of bridge deck amidships, the crew are berthed in poop aft, and the forecastle is fitted up for the accommodation of the cattlemen. Steam heating is provided throughout all the cabin accommodation. The engines are of the triple-expansion type, having cylinders 26 in., 43 in. and 71 in. by 48 in. stroke; steam being supplied by two large multitubular boilers, which will be fitted with Howden's patent system of forced draught, and 180 lbs. steam pressure. A large donkey boiler, 180 lbs. pressure (connected to main boilers), for supplying steam to deck machinery, &c., is placed on upper deck. Both engines and boilers are being constructed by Messrs. Robert Stephenson & Co., Limited, and the whole of the work has been under the supervision of the owners' superintending engineer, Mr. John Baxter, of Newcastle-on-Tyne. On leaving the ways the vessel was gracefully named the *West Point* by Mrs. C. W. Metcalf Dale, wife of the chairman of the Norfolk & North American Steam Shipping Co., Limited.

Jokai.—On March 28th Messrs. R. Craggs & Sons launched at Middlesbrough a steel screw steamer, 351 ft. by 42 ft. 6 in. by 24 ft. 9 in., built to the order of the Royal Hungarian Sea Navigation Co. "Adria," Limited, of Fiume, under special survey and to the highest class 100 A1 at Lloyd's and Austrian Veritas, as a spar-deck vessel with two decks laid, the main deck being of steel and spar deck of checkered iron. The vessel is to be rigged as a two-masted schooner, and is designed to carry a deadweight of about 4,000 tons on a moderate draught. Powerful machinery is being supplied by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, which will be capable of driving the vessel between 10 and 11 knots laden. During the construction of hull and machinery, the work has been under the superintendence of Mr. Alex. Rolland, chief inspector to the owners, and his resident assistant, Mr. Cammera. The vessel was named *Jokai*.

Falaise.—On March 29th the steam yacht *Falaise*, which has been built by Messrs. Day, Summers & Co., of Southampton, to the order of Mr. Forrester Britten, of Shermanbury Grange, Henfield, Sussex, from the designs of Messrs. Thomson & Campbell, of London, was launched at Northam. The principal dimensions of the *Falaise* are as follows:—Length, between perpendiculars, 120 ft. 6 in.; breadth, 18 ft. 6 in.; depth, 12 ft. 3½ in.; tonnage, B.M., 200. The engines are of the compound surface-condensing type, with cylinders 15 in. and 30 in. diameter by 23 in. stroke, steam being supplied by a return-tube boiler 10 ft. 6 in. in diameter by 9 ft. long, having two furnaces, designed for a pressure of 110 lbs. The vessel and machinery have been constructed to Lloyd's highest class.

Milton.—On March 29th this vessel was launched by Messrs. Joseph L. Thompson & Sons, Limited, Sunderland, and has been built to the order of Messrs. Glover Brothers, of London, and is the twenty-fifth vessel ordered by this firm from these builders. She is built on the awning deck rules, her principal dimensions being:—Length, 338 ft.; breadth, 44 ft. 6 in.; and depth, moulded, 22 ft. 2 in. The engines and boilers are being constructed by Messrs. Thomas Richardson & Sons, Limited, of Hartlepool, the sizes of the cylinders being 24 in., 38 in., 64 in. by 42 in. stroke, supplied with steam by two large multitubular boilers working at 160 lbs. pressure.

Novington.—On March 29th Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions, viz.:—Length, overall, 323 ft.; breadth, extreme, 44 ft. 6 in.; depth, moulded, 23 ft. 1 in.; gross tonnage about 2,400 tons. This vessel, which has been built to the order of the Southdown Steamship Co., Limited, London (Messrs. Bell, Symondson & Co., managers), will take Lloyd's 100 A1 class, and has been built under special survey. She is of the single-deck type with deep framing, and has poop for captain and officers, bridge over engines and boilers, with engineers' berths in after end, and topgallant forecastle for crew. A cellular double-bottom and after peak tank are fitted for water ballast, and equipment includes four steam winches, large vertical donkey boiler, stockless anchors, steam windlass, steam steering gear, &c. The engines by Messrs. Blair & Co., Limited, have cylinders 23 in., 37½ in., 61½ in. by 39 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 160 lbs. As the vessel left the ways she was christened *Novington* by Miss Edith Bell, of Newcastle-on-Tyne.

King Erik.—On March 29th there was launched at Selby, for the Viking Steam Fishing Co., of Grimsby, an iron steam ketch of about 228 tons gross, named the *King Erik*.

Thordis.—On March 29th there was launched by Messrs. Osbourne, Graham & Co., at Hylton, near Sunderland, a steamer, built to the order of Mr. W. Wilhelmsen, of Tonsberg, Norway. The vessel will take the highest class at Lloyd's, and also at the Norwegian Veritas. Her dimensions are:—Length, 351 ft.; breadth, extreme, 48 ft.; and depth, moulded, 29 ft. She will be fitted with triple-expansion engines by Messrs. Blair & Co., of Stockton, having cylinders of 24 in., 40 in., and 66 in., by 45 in. stroke. The vessel was named *Thordis*.

Viking.—On March 29th there was launched at Hull for Messrs. J. H. Robins & Co., Limited, of Hull, an iron steam ketch of about 182 tons gross, named the *Viking*.

Castro.—On March 30th there was launched at Hull, for Messrs. T. Wilson, Sons & Co., Limited, of Hull, a steel schooner-rigged steamer, of about 1,150 tons gross, named the *Castro*.

Dartmeet.—On March 30th Messrs. R. Craggs & Sons launched at Middlesbrough a fine steel screw raised quarter-deck steamer named *Dartmeet*, 190 ft. between perpendiculars; 30 ft. breadth, extreme; and 15 ft. 11 in. depth moulded; built to the order of Messrs. Whiteway & Ball, shipowners, of Torquay. The steamer will take Lloyd's highest 100 A1 class, and is designed to carry a dead veight of 1,075 tons. The vessel will be provided with machinery supplied by Sir C. Furness, Westgarth & Co., Limited, capable of giving her an average speed of about 10 knots when loaded at sea.

Sangara.—On Saturday April 8th, Messrs. Furness, Withy & Co., Limited, launched from their Middleton Shipyard, Hartlepool, the large steel screw-steamer *Sangara*, built to the order of Messrs. Elder, Dempster & Co., Liverpool. The vessel is a duplicate of the s.s. *Degama*, built by Furness, Withy & Co. for the same owners. She is a fine type of a modern cargo boat, measuring over 350 ft. in length, and built throughout of Siemens-Martin steel to Lloyd's highest class, having large measurement and deadweight carrying capacity. The vessel is of the spar-deck type, with poop, bridge and forecastle, and arrangements fitted for carrying cattle on deck. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Six powerful steam winches, donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, and other modern appliances are fitted for the handy working of the ship. The saloon and cabin, which provides accommodation for the captain, etc., is handsomely finished in polished hardwood. The vessel will be rigged as a two-masted fore-and-aft schooner, and has been constructed under the supervision of Captain Evans and Mr. T. Hall. Triple-expansion engines will be fitted by Sir C. Furness, Westgarth & Co., Limited, Middlesbro'.

Archanda.—On Tuesday, April 11th, Messrs. Craig, Taylor and Co., launched a fine steel screw steamer from the new portion of their shipbuilding yard into the new turning berth at Thornaby-on-Tees. The dimensions of the vessel are 299 ft. by 43 ft. by 21 ft. 3 in. moulded. She is of the single deck type, with poop, bridge, and topgallant forecastle, and is built to the highest class in Lloyd's, under special survey. She is fitted throughout with water ballast on the double cellular principle, and is built with deep frames, thus giving clear holds for stowing cargo. She will be fitted with 4 double-powered steam winches, patent steam windlass, patent steam steering gear, large donkey boiler, screw gear aft, telescopic masts, and all modern improvements. Triple-expansion engines have been constructed by Messrs. T. Richardson & Sons, Limited, Hartlepool, the size being 22 in., 35 in., 59 in. by 39 in., with 2 large boilers working at 160 lbs pressure. The vessel has been built to the order of Mr. Felix de Abasolo, of Bilbao, and under the superintendence of Mr. Andres Mendiguren. As the vessel left the ways she was gracefully christened the *Archanda* by Miss Harney, daughter of Captain Harney, of Blyth.

Pomona.—On April 11th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill shipyard, Beverley, a steam trawler of the following dimensions, 106 ft. 4 in by 21 ft. by 11 ft. depth of hold, built to the order of the Hull Steam Fishing & Ice Co., Limited. The vessel was named s.s. *Pomona* by Mrs. Beath, of Hull. Messrs. Amos & Smith are supplying engines of the triple-expansion type, and the vessel will be completed ready for sea with the most modern appliances for trawling.

Milwaukee.—On April 12th an interesting ceremony took place when a large company of visitors assembled at the shipbuilding yard of Messrs. C. S. Swan & Hunter, Limited, to witness the launch of the fore end of the s.s. *Milwaukee*. It will be remembered that the *Milwaukee* (of which we gave full particulars in our columns, December, 1896, page 373; and February, 1897, page 467), a large steamer, 483 ft. long, overall; and 56 ft. beam, owned by Messrs. Elder, Dempster & Co., of Liverpool, when on a voyage from the Tyne to New Orleans, went ashore in Cruden Bay, near Aberdeen, in the month of September last. It was found that a large rock had penetrated the bottom to a height of about 8 ft. above the tank top, and Capt. Batchelor, who had charge of the salvage operations, saw that it was impossible to salve the whole vessel so it was decided to blow her in two with charges of dynamite. This was successfully done, leaving about 180 ft. of the fore end on the rocks, and the after end, with the assistance of tugs, steamed back to the Tyne, where she has been lying waiting for the new fore end which was successfully launched. The old and the new ends will be towed in a few days' time to the dry dock of the Tyne Pontoons & Dry Docks Co., Limited, where they will be joined together.

Warwick.—On Thursday afternoon, April 13th, there was launched from the shipbuilding and repairing works of the Blyth Shipbuilding Co., Limited, of Blyth, a steel screw-steamer, built to the order of Messrs. Atkinson Bros., of Newcastle-on-Tyne. The dimensions of this vessel are:—Length, 243 ft.; breadth, 36½ ft.; depth, 18 ft. 9 in. She is classed 100 A1 at Lloyd's, and is built on the single-deck principle, with poop, bridge, and topgallant forecastle, and has deep frames, but no hold beams. The cabin accommodation is fitted in poop aft, the engineers being berthed under the bridge amidships and the crew in forecastle. Triple-expansion engines will be supplied and fitted by the North-Eastern Marine Engineering Co., Limited, of Wallsend. As the vessel left the ways the ceremony of naming her *Warwick* was gracefully performed by Miss Dolly Cookson, younger daughter of Norman C. Cookson, Esq., of Oakwood. The ship and engines have been built under the inspection of Mr. James Dykes, of Newcastle.

Nunimu.—On Monday, April 24th, Messrs. Wm. Gray & Co., Limited, launched a fine large steel screw steamer to the order of Messrs. Trechmann Bros., of West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions, viz.:—Length overall, 341 ft.; breadth, 47 ft.; depth, 27 ft. 4 in., with long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's room, &c., will be fitted up in a large deck-house amidships. The officers' and engineers' accommodation will also be on the bridge-deck, and the crew's berths in the forecastle. The hull is built with deep frames, large hatchways are fitted, a large horizontal multitubular donkey boiler, six steam winches with copper exhaust pipes and condenser tank, steam steering gear amidships, hand-screw gear aft and patent direct steam windlass, cellular double bottom and large aft peak tank for water ballast, iron middle line bulkhead to prevent cargo shifting, stockless anchors, telescopic masts with fore-and-aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, having cylinders 25 in., 40 in., and 65 in. diameter, with a piston stroke of 42 in., and large steel boilers for a working pressure of 160 lbs. per square inch. The ceremony of naming the vessel *Nunimu* (after the wife of Dr. Emil Trechmann, Sydney, New South Wales) was gracefully performed by Miss Wanda Trechmann, daughter of Mr. O. K. Trechmann, West Hartlepool.

LAUNCHES—SCOTCH.

Magnific—On March 14th there was launched at Dundee for the Atlantic Steam Fishing Co., of Grimsby, a steel schooner-rigged steamer of about 244 tons, named the *Magnific*.

St. Anthony—On March 22nd there was launched at Greenock, by Messrs. Taylor & Mitchell, a salvage steamer for Mr. J. M'Causland, of Portaferry. The vessel has been constructed with all the latest improvements for salvage work. The engines, which are of the compound type, are being supplied by the owner. The vessel was named *St. Anthony*.

Neptune and **Diana**.—On March 24th Messrs. Mackie & Thomson launched at Govan the steam fishing vessels *Neptune* and *Diana*, which they have built for Mr. W. Widdowson, Hull. Dimensions:—Length, 112 ft.; breadth, 21 ft.; depth, moulded, 12 ft.; tonnage, 180 gross. Triple-expansion engines of 425 I.H.P. will be fitted by Messrs. Muir & Houston.

Seapoint.—On March 25th there was launched from the shipyard of Messrs. S. McKnight & Co., Limited, of Ayr, a fine steel screw cargo steamer of the following dimensions:—Length, 175 ft.; breadth, 26 ft. 6in.; depth, 13 ft. She has been constructed for cargo-carrying purposes for a well-known Irish firm, and is built to the highest class of Lloyd's and up to the most recent modern standard. She is to be fitted with powerful compound surface-condensing machinery by Messrs. McKie & Baxter of Govan. The vessel on leaving the ways was gracefully christened *Seapoint* by Mrs. W. Scott, Bellevue Terrace, Ayr. She will proceed to Glasgow in the course of a day or two to receive her machinery.

Dreadnought and **Defender**.—On March 25th Messrs. Gourlay Brothers launched at Dundee two steel steam trawlers for the Dundee Steam Trawling Co., Limited. The vessels are intended to develop the fishing trade of the port, and were christened *Dreadnought* and *Defender*. The trawlers are built to the highest class at Lloyd's, and under special survey, and the principal dimensions are:—Length, 100 ft.; breadth, 20 ft.; depth, 11 ft.; and gross tonnage, 130 tons. The machinery will be supplied by the builders, and consists of triple-expansion engines.

Dredger.—On March 28th Messrs. Wm. Simons & Co., Limited, Renfrew, launched complete from their yard a powerful barge-loading dredger for the Russian Government. This vessel has been constructed under the inspection of, and is also classed by the Bureau-Veritas. Independent steam hoisting gear is provided for manipulating the bucket ladder, and also independent steam winches are fitted at bow and stern of vessel for manœuvring the vessel when at work. Electric light is fitted on deck and throughout the vessel for working day and night. There are separate cabins for the officers and crew and a private cabin on deck is also provided.

Hortensius.—On March 28th Messrs. Archibald McMillan & Son, Limited, shipbuilders, Dumbarton, launched the steel screw steamer *Hortensius*, building by them to the order of Messrs. R. P. Houston & Co., Liverpool. The dimensions are:—362 ft. by 47 ft. by 27 ft. 6 in., and the gross register is 3,500 tons. A complete shelter deck is fitted over the upper deck, and on top of shelter deck accommodation is provided in large deckhouses for captain, officers, engineers, and a few passengers, while under the deck the crew are accommodated forward, and cattlemen, &c., aft. Three decks will be completely fitted up for cattle, while the water service, condensing apparatus, and ventilation in this connection are of the most perfect description. Water ballast is provided for in cellular double bottom, which is subdivided, so as to give storage room for fresh water for cattle and boilers. All latest improvements have been introduced for the speedy loading and discharging of cargo, and altogether the vessel will be fitted out in a very superior manner. The engines are triple-expansion, having cylinders 26 in., 43½ in., 72½ in. by 48 in. stroke, with three large single-ended boilers. The vessel is intended for the River Plate service, with which the owners have had long connection, and as Mr. Houston has designed the vessel to meet the special requirements of this trade, the *Hortensius* should prove a valuable addition to the fleet of vessels already in Messrs. Houston's service. The vessel and machinery have been built to Lloyd's highest class, and under the supervision of Mr. William McLaren and Captain Hopkins, the company's superintendents. The christening ceremony was gracefully performed by Mrs. William McLaren, Rock Park, Rock Ferry, Birkenhead.

Upada.—On March 28th Messrs. A. & J. Inglis launched from Pointhouse yard, on the Clyde, a screw-steamer for the British India Steam Navigation Co. of 5,600 tons gross and 2,300 I.H.P. The vessel, which was named the *Upada*, will be employed in the Indian coasting trade.

Zealandia.—On March 29th Messrs. Gourlay, Brothers & Co. launched at Dundee a steel screw passenger steamer for Messrs. Huddart, Parker & Co., Limited, Melbourne. The vessel, which was named *Zealandia*, is intended for passenger and cargo traffic between the principal ports of Victoria, New South Wales, New Zealand, &c. Her principal dimensions are :—Length, 327 ft. ; breadth, 42 ft. ; depth, 23 ft. ; with a gross tonnage of 2,900.

Rembrandt.—On March 29th there was launched from the shipbuilding yard of Messrs. David & Wm. Henderson & Co., Partick, a very complete steel screw cattle steamer, which they have built to the order of Messrs. Lamport & Holt, Liverpool, for their South American trade. The vessel—which is 394 ft. over all, by 50 ft. broad, and 30 ft 6 in. depth, to carry 6,550 tons deadweight on British Corporation summer freeboard—has been constructed under special survey to class B S in British Corporation registry of shipping. The vessel is built with a shade deck right fore and aft, on which it is intended to carry sheep; whilst the main deck will be fitted up for carrying cattle, to which special attention has been given, and the most approved modern appliances in this connection fitted. The cattle fittings are adjustable, and can be quickly removed if necessary. In regard to the ventilation of the cattle space, every care has been taken. In addition to the very large number of natural draught ventilators, there are two specially designed ones, placed amidships, and each fitted with powerful steam driven fans to circulate the air. Between the top of the main deck bulwark and the shade deck there is an opening two to three feet wide, and extending a considerable distance forward and aft of the amidships portion of the ship; through the openings, in conjunction with the ventilators, an ample supply of fresh air is always obtainable, and in bad weather these openings can be planked in, thus practically enclosing the whole of the main deck. A very efficient fresh water service is provided both above and below. The ship has a cellular double bottom right fore and aft for water ballast, the portion under the engines and boilers being set aside for fresh water in view of the large number of cattle the vessel will at times be carrying. The fore and aft peaks are also arranged for use as trimming tanks. The vessel has also been provided with seven powerful steam winches and derricks, to facilitate the rapid handling of the large cargo which, in addition to the cattle, she has been designed to carry. Quarter pillars have been dispensed with in the principal holds and 'tween decks, thus ensuring ample clear space for stowing bulky cargo. Steam steering gear by Messrs. Bow, MacLachlan & Co. has been fitted amidships, and also hand steering gear by the builders aft; steam capstan windlass forward by Messrs. Emerson, Walker & Thompson Bros., and a very complete installation of electric light supplied and fitted by Messrs. W. C. Martin & Co. Houses have been fitted on the shade deck amidships for the accommodation of the officers and engineers, with saloon, steel specie-room, bath-rooms, &c. The saloon is neatly and tastefully fitted up in polished oak with upholstery of colour to match the same; on top of the saloon house there is a teak-house for captain, chart-room, and wheel-house. The seamen, firemen, and petty officers are berthed forward under the shade deck, whilst the necessary accommodation for the cattlemen has been arranged at the after-end, also under the shade deck. A complete system of steam heating has been fitted in all living accommodation. The vessel will be rigged as a two-masted fore-and-aft schooner, having steel lower masts and telescopic wood topmasts to suit Manchester Canal. A set of triple-expansion engines, with cylinders 27½ in., 46 in. and 74 in. by 48 in. stroke, and three single-ended boilers constructed for a working pressure of 180 lbs., have been supplied and fitted by the builders, the boilers being of extra large size and arranged for Howden's forced draught system. In designing this steamer, every possible advantage has been taken of the vast experience of the owners for their special trade, and therefore both ship and machinery have been fitted throughout with the most recent improvements for a thoroughly up-to-date first-class cattle and cargo steamer. The vessel will form a valuable addition to the already large fleet of steamers employed by the owners in their extensive trade to South American ports, and is a sister ship to the s.s. *Raphael* lately completed bv the builders for Messrs. Lamport & Holt. During construction, the hull has been built under the supervision of Mr. John Russell, and the machinery under that of Mr. Morrin and Mr. Fred Thompson. On leaving the ways the vessel was gracefully named *Rembrandt* by Mrs. Herbert Pilkington, of Wheathill, Huyton, Lancashire.

Upnor, H.M.S.—On March 30th Messrs. J. M'Arthur & Co., Paisley, launched from their shipyard H.M.S. *Upnor*, a steel single-screw steamer of about 500 tons gross. The *Upnor*, which has been built throughout to Admiralty requirements and under Admiralty supervision, is to be engaged as a store-carrying vessel for the Naval Ordnance Department. The vessel is built with raised quarter-deck, raised forecastle, and has propelling machinery close aft, in order to give one long clear hold and one long loading hatch. Pillars in hold are dispensed with thus giving ample and free uninterrupted space for stowing heavy guns or other bulky loads. The *Upnor* is fitted with a complete equipment to make the vessel thoroughly suitable for the purposes she has been designed and built for. The engines, which are of the compound surface-condensing type with all latest improvements, are being supplied and fitted by Messrs. Bow, M'Lachlan & Co., Thistle Works, Paisley. On leaving the ways the vessel was named by Miss Bow, Dunscore, Paisley.

Angele Achaque and **Carmel** and **Charles Achaque.**—On April 1st Messrs. John Shearer & Son launched at Kelvinhaugh, the steamers *Angele Achaque* and *Carmel* and *Charles Achaque*. The vessel were built to the order of Messrs. Paton Hendry, Glasgow, to plans prepared by James Donaldson, C.E., and under his supervision. They are exceptionally strong and well equipped, having been built in excess of Lloyd's 100 A1 requirements to permit of loading and discharging on the ground. Powerful compound surface-condensing engines to drive the steamers at a high speed are being fitted by Messrs. Muir & Houston, Limited. After trials the vessel will leave the Clyde for Algiers, where they will be engaged in the Algerian coasting service of Messrs. Achaque, Algiers, to whom they have been sold by Messrs. Paton & Hendry.

Lucy.—On April 1st Messrs. Scott & Sons launched at Bowling a screw steamer which they have built to the order of Messrs. Joseph Monks & Co., Limited, Warrington. Dimensions :—Length, 90 ft. ; breadth, 20 ft. 6 in. ; and depth, moulded, 10 ft. The vessel is to be fitted with compound surface-condensing engines by Messrs. Fisher & Co., Paisley. She was named *Lucy* by Mrs. Joseph Monks, jun., Warrington.

Lincolnshire.—On April 3rd Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, the steel screw spar-decked steamer *Lincolnshire*, for Messrs. J. & A. Roxburgh, Glasgow. The steamer measures :—Length, 345 ft. ; breadth, 49 ft. 9 in. ; depth, 28 ft. 6 in. moulded. The deadweight carrying capacity on Lloyd's summer freeboard is 6,400 tons. Messrs. Rankin & Blackmore, Greenock, will supply triple-expansion engines of 25 in., 41 in., and 67 by 45 in. stroke.

Renown.—On April 8th Mr. James Miller launched at St. Monans a first-class fishing boat, 69 ft. in length, with a breadth of beam 21 ft. 6 in , built to the order of Mr. Andrew Scott, of that port. The boat was named the *Renown*.

Irene.—On April 10th the Grangemouth Dockyard Co. launched from their yard at Grangemouth the steel screw steamer *Irene*, built to the order of Messrs. Furness, Withy & Co., of West Hartlepool, for Mr. C. Hulthen, of Helsingborg. This vessel is a duplicate order to the s.s. *Muriel*, built last year by the Grangemouth Dockyard Co., for Messrs. Furness, Withy & Co., and is fitted up with all modern appliances for a cargo vessel with a view principally to the carriage of grain and wood cargoes, comprising grain shifting boards and ventilators, deck arrangements for wood cargoes, large water ballast capacity, steam steering gear, quick warping steam windlass, and steam warping capstan. Her dimensions are: 270 ft. by 40 ft. 6 in. by 20 ft. 6 in., and she is built on the bulb frame principle with single deck, poop, bridge, and forecastle. She will carry a total weight of 3,100 tons with Lloyd's summer freeboard, and has a low net tonnage. The engines are triple-expansion, having cylinders 20 in., 32½ in., and 53 in. by 36 in. stroke, and steam will be supplied by two large single-ended boilers working at a pressure of 160 lbs. The donkey boiler is of Blake's patent type. The construction of the vessel has been superintended on behalf of Messrs. Furness, Withy & Co. by Mr. A. Walker, shipbuilding superintendent, and on behalf of Mr. Hulthen, by Captain Borjessen, assisted by Mr. James Donaldson, consulting engineer, of Glasgow, who has also superintended the construction of the machinery. On leaving her building berth the ceremony of naming the vessel was gracefully performed by Mrs. Harvey, of Prospect House, Polmont. The Grangemouth Dockyard Co. are at present exceedingly busy, having seven vessels on hand, two of these being large steamers fitted for carriage of oil in bulk.

Salamis.—There was launched on April 11th from the shipbuilding yard of Messrs. Hall, Russell & Co. Limited, Aberdeen, a large steel screw-steamer, built to the order of Messrs. George Thompson & Co., of Aberdeen and London, for their service between London and Australia. The vessel is the largest by 1,000 tons ever set afloat at Aberdeen. Her dimensions are:—Length over all, 412 ft.; breadth, 47 ft.; depth, 32 ft. 3 in. She is 4,700 tons register, and has engines of 4,300 I.H.P. The hull and machinery have been built under special survey to class 100 A1 at Lloyd's, and with all the most modern requirements to pass the Board of Trade for a passenger certificate. The vessel has been constructed on the spar-deck principle, having three complete steel decks, full poop, bridge-deck and topgallant-forecastle, and above the bridge-deck a shelter-deck is fitted, on which the boats are placed, and at the fore-end a navigating bridge. Water ballast tanks are fitted amidships in cellular double-bottom and in afterpeak. On leaving the ways the ceremony of christening the steamer *Salamis* was gracefully performed by Mrs. George T. Henderson, London. The *Salamis* will be commanded by Captain A. H. Douglas, R.N.R., formerly of the s.s. *Damascus*, of the same line.

Ziska.—On April 11th the Ailsa Shipbuilding Co. launched at Troon a steel screw steam yacht, designed by Mr. A. Richardson, of Liverpool, for Mr. S. T. Chadwick, of Haulfre, Anglesey. The dimensions are:—Length on load water-line, 101 ft. 8 in.; breadth, moulded, 18 ft. 6 in.; depth, moulded, 11 ft. 6 in. The machinery, which is of the triple-expansion type, is being fitted by Messrs. Muir & Houston, Limited, of Kinning Park Works, Glasgow. On leaving the ways the yacht was named *Ziska* by Mrs. Chadwick.

Ismore.—On April 12th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Limited, Clydeholm, Glasgow, a steel screw-steamer, built to the order of Messrs. Edward Bates & Sons, Liverpool. The vessel is classed at Lloyd's 100 A1 on the three-deck rule, with additional extra strengthening for trading in the North Atlantic, and has continuous shelter-deck all fore and aft, on which cattle fittings are fitted up complete in the most approved modern style. The vessel has a deep tank placed aft for trimming when light, and is fitted with all the best appliances for the working of ship and cargo. While under construction the ship and machinery were under the supervision of Messrs. Clark & Garrick. Her moulded dimensions are 452 ft. by 53 ft. 3 in. by 34 ft. 1 in., and measures about 6,200 tons gross. On leaving the ways the vessel was named *Ismore* by Mrs. Maclean, Ardgour, Balshagray Avenue, Partick, and was afterwards towed to the harbour to receive her machinery, which is being supplied by the builders.

Cork.—On April 12th Messrs. Blackwood & Gordon launched at Port-Glasgow a steel screw-steamer, to the order of the City of Dublin Steam Packet Co., of Dublin, to be employed in the cross-channel trade between Dublin and Liverpool, as consort to the four popular steamers, *Louth*, *Wicklow*, *Carlow*, and *Kerry*, which steamers were also built by Messrs. Blackwood & Gordon. The steamer on leaving the ways was named the *Cork* by Mrs. D. B. M'Geoch, wife of the senior partner of the builders' firm, and was afterwards placed in the builders' wet dock, alongside of their works, to receive her machinery and boilers, which have also been constructed by the builders. The dimensions of the *Cork* are as follows:—Length, 260 ft.; breadth, 34 ft.; depth, 16 ft. 9 in.; having also a long poop, bridge and forecastle, with short breaks filled in, and a gross tonnage of about 1,300 tons. The hull is constructed of heavy scantlings very much in excess of the requirements of Lloyd's class, and of full lines, suitable for the cross-channel trade in all sorts of weather. She is fitted with Harrison's patent steam-steering gear. Wilson's patent steam windlass forward, and their patent steam capstan aft; also one powerful steam crane and steam winch, also of Wilson's make. Suitable cattle fittings for fully 500 cattle are placed in the holds, 'tween and main decks, and efficient mechanical ventilation with large ventilators will be provided, so as to ensure the safe and comfortable conveyance of live stock, special attention having been given to this very important question by the builders, acting on the instructions of the managing directors, who by their long experience of shipping matters are thoroughly conversant with all the newest requirements of vessels engaged in the cattle trade. Accommodation for 150 first-class passengers in all has been provided in cabins on bridge-deck, also in cabins in large house on poop-deck, and in main saloon under poop-deck. A comfortable and well-ventilated cabin has been fitted up for the exclusive use of cattle dealers, and also a large and airy steerage has been arranged forward for third-class passengers, separate apartments being provided for male and female passengers. Electric light, by Siemens Brothers, is being fitted up in all the holds, engine and boiler-rooms, and in all parts of the accommodation. A comfortable smoking-room is placed on bridge-deck amidships, and the captain and chief officers are located in a teak deckhouse placed above the smoking-room, from which they have easy access to the flying bridge, which is placed above their rooms. Water ballast tanks are fitted in fore and after holds with special pumps for filling and emptying quickly. The engines are of the triple-expansion type, of fully 3,000 H.P., with all the latest improvements, including bronze propeller, and are supplied with steam from two large double-ended boilers, working up to 170 lbs. pressure. The *Cork* is built on similar lines to the former steamers, but with the improvement that she has accommodation for 50 additional first-class passengers over *Carlow* and *Kerry*, placed in private cabins amidships, and has also a larger smoking-room. During construction she has been under the supervision of Mr. Edwin G. Ferber, the engineering superintendent of the City of Dublin Co. Among those present were:—Captain George R. Bell and Mrs. Bell, Liverpool; Mr. E. G. Ferber, engineering superintendent of the company; Mr. and Mrs. D. B. M'Geoch, Mr. F. P. Purvis, Mr. and Mrs. J. H. M'Alpine, Miss M'Geoch, Paisley; Mr. George Gow, New Zealand; Mr. H. H. Broadley, East Yorkshire; Mr. William Baird, Mr. G. A. Fullarton, &c. After luncheon, Mr. M'Geoch proposed "Success to the steamer *Cork* and her owners." He said this was the sixth steamer his firm had built for this old-established and well-known Irish company. All her predecessors had proved themselves efficient and satisfactory to the cattle-dealers and the travelling public, and he had no doubt the *Cork* would maintain the prestige of the company in the safe and efficient service they had so long conducted between Dublin and Liverpool. Captain Bell, R.N., marine superintendent of the company at Liverpool, replying, said this new steamer was of a similar type to those they had already seen launched by Messrs. Blackwood & Gordon, and which had been the means of greatly strengthening the company. It was a very expensive matter to keep pace with the times, but they had to do it or be left behind. The former steamers had all proved successful vessels to the company, and he felt quite sure the *Cork* would give every satisfaction. Mr. Bell then proposed the health of Mrs. M'Geoch, the lady who named the steamer, and Mr. M'Geoch replied. Mr. Broadley submitted the toast of "The Builders," and Mr. F. P. Purvis responded.

Burton-Port.—On April 14th Messrs. John Fullerton & Co. launched at Paisley a steel screw-steamer of about 300 tons, which has been built to the order of Mr. John Herdman, Carricklee, Strabane, for his local and Channel trade, and for which the steamer has been specially designed and equipped, being fitted with steam-steering gear, electric light, &c. Compound engines of 350 H.P. are being supplied by Messrs. Muir & Houston, Limited, Glasgow. The steamer was named *Burton-Port*, by Mrs. Buchanan, Redhurst, Bridge of Weir.

Clan Maclaren.—On April 24th the sixteenth steamer built by Messrs. Alex. Stephen & Sons for the Clan Line was launched at Linthouse, and was named the *Clan Maclaren* by Mrs. John F. Maclaren, of Merrylee, Cathcart. The dimensions of the vessel—which is a duplicate of the *Clan Macaulay*, recently launched by the same firm - are 326 ft. by 40 ft. 3 in. by 26 ft. 2 in., and she is built under special survey to the 100 A1 three-deck-rule of Lloyd's. The cylinders are 23 in., 38 in., and 63 in. diameter, with a stroke of 43 in ; and the boilers, which are adapted for 800 lbs. working pressure, are fitted with Howden's forced draught. The vessel in design, fittings, and appliances is of the most modern and approved description. Messrs. Stephen have another steamer in hand for the Clan Line.

LAUNCH—Irish.

Ping Suey.—On March 30th, at high water, Messrs. Workman, Clark & Co., Limited, Belfast, launched from their north shipyard a large steel screw-steamer, named the *Ping Suey*, designed to suit the Eastern trade carried on by the China Mutual Steam Navigation Co , of London. The dimensions are:—Length, 450 ft.; breadth, 53 ft.; depth moulded, 33 ft. 11 in.; with a gross tonnage of 6,457 tons, deadweight capacity 9,200 tons. After the launch a tug conveyed the owners and friends on board the *Yangtsze*, a sister ship of the *Ping Suey*, which, earlier in the morning, had proceeded down Belfast Lough. This vessel has been built for the same owners under Lloyd's special survey for the 100 A1 class, and is provided with a Board of Trade passenger certificate. The machinery, which has been constructed at the builders' engine works, consists of triple-expansion engines and two large steel boilers fitted with Howden's system of forced draught.

TRIAL TRIPS.

Moorabool.—On March 24th the screw-steamer *Moorabool*, built by the Blyth Shipbuilding Co., Limited, for Messrs. Huddart Parker & Co., Limited, of Melbourne, was taken to sea for her trial trip. The dimensions of the vessel are:—Length, 337 ft.; breadth, 47 ft.; depth, 24 ft. 10 in. She has been built to Lloyd's highest class and is fitted with all the latest appliances for quick discharging of cargo; has Emerson Walker's patent windlass, four of Clarke Chapman's winches, and four friction winches by Messrs. J. Lynn & Co., of Sunderland. Messrs. Blair & Co., Limited, of Stockton, have supplied the engines, which are of the triple-expansion type having cylinders 24 in., 40 in. and 65 in. by 42 in.-stroke, to Lloyd's and Board of Trade regulations. Notwithstanding the heavy sea running the performances of both ship and machinery were in every way highly satisfactory. During construction the hull and engines have been under the superintendence of Mr. W. Cumming, the owners' engineer. After trial the vessel proceeded to London, under the command of Captain W. Laws, where she will load a general cargo for Melbourne.

Bethania.—On March 25th the s.s. *Bethania*, the second of two steamers built and engined by Messrs. Alex. Stephen & Sons, Linthouse, Glasgow, to the order of Sir Christopher Furness for the Hamburg-America Co., Hamburg (of which we gave full particulars in our columns, February issue, page 473), ran her trial trip in the Firth. The machinery consists of a set of triple-expansion, surface-condensing engines. Steam is supplied by four large boilers having 18 furnaces in all, and working at a pressure of 180 lbs. per square inch. The boilers are constructed under the rules of Lloyd's, Board of Trade and the Hamburg Police Building Board. The engine room contains a number of auxiliary engines, such as two Weir's feed pumps; centrifugal circulating pump by Drysdale & Co.; two service duplex pumps—Worthington Admiralty pattern; duplex pump for pumping fresh water to cattle; also Quiggin's combined evaporator and winch condenser. A large pulsometer is fitted as a ballast pump. The propeller blades are of Parson's manganese bronze. For discharging cargo fourteen powerful winches are fitted on deck, one main boiler being used as an auxiliary boiler in port. The steam and hand steering gear and patent rudder brake are by John Hastie & Co., Greenock, who also constructed the Wilson & Pirrie patent elastic quadrant. Mr. Blumenthal represented the Hamburg-America Co. at the trial, which was a highly satisfactory one in every respect. The *Bethania* and her sister ship, the *Bengalia*, have been completed under the superintendence of Mr. van der Smissen, assisted by Mr. Brandt. She is commanded by Captain Pietsch.

Saint Andrew.—On March 25th, the twin-screw-steamer *Saint Andrew*, which has been built for Messrs. Rankin, Gilmour & Co., of Liverpool, by C. S. Swan & Hunter, Limited, Wallsend (of which we gave full particulars in our Launch columns, February issue, page 475), was taken out to sea on her trial trip. The vessel will carry a dead-weight cargo of about 10,700 tons, and a measurement cargo of 18,000 tons. On the trial everything worked with perfect smoothness, and a mean speed of over 14 knots was obtained by the log, the mile posts being invisible owing to fog. The vessel and her engines have been built under the supervision of Captain Davey and Mr. Reid, the marine superintendent and superintendent-engineer, for the owners, who expressed themselves highly satisfied with the way everything worked.

Wandby.—On Saturday, March 25th, the s.s. *Wandby*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. R. Ropner & Co., West Hartlepool (of which we gave full particulars in our Launch columns, April issue, page 40), made her official trial trip in the Tees Bay. The engines are supplied by the well-known firm of Messrs. Blair & Co., Limited, Stockton, the power of same being 1,250 I.H.P. The trial trip was quite satisfactory in every respect, the steamer attaining a speed of 11 knots between the Tees and the Tyne. The owners were represented by Mr. Rooke, one of their superintendents, and the builders by Mr. Leonard Ropner.

Gwynwood.—On March 29th the new steel screw-steamer *Gwynwood*, built by Messrs. William Dobson & Co., Low Walker-on-Tyne, to the order of Messrs. H. C. Pelly & Co., of London, was taken to sea for her trial trip. The dimensions of the vessel are:—Length, 212 ft.; breadth, 35 ft.; depth, moulded, 16 ft. 5 in. The machinery, which has been constructed by the North-Eastern Marine Engineering Co., Limited, is of the triple-expansion type, having cylinders 18½ in., 30 in. and 49 in. diameter, by 33-in. stroke, steam being supplied by one large boiler working at 160 lbs. pressure. The working of the machinery during the trip was all that could be desired.

Windsor Castle.—On March 31st the steam trawler, *Windsor Castle*, built by Messrs. Cochrane & Cooper, Beverley, in the yard at Govan, (of which we gave full particulars in our Launch columns, March issue, page 516) went down the Clyde on a trial trip. The trial was in every way satisfactory, a speed of 11 knots being attained.

Clan Macaulay.—On April 1st, the fine steel screw-steamer *Clan Macaulay* proceeded down the river on her trial trip. This is the fifteenth vessel which Messrs Alex. Stephen & Sons have constructed for the Clan Line (of which we gave full particulars in our Launch columns, April issue, page 42). On a mean of two runs over the measured mile the speed attained was 12·29 knots, the ship being within a few inches of her load line. The machinery worked with perfect smoothness, and the owners, represented by Mr. Gibb and Mr. Lyall, expressed themselves as highly pleased with the vessel's performance.

Mundaka.—On April 5th, the fine steel screw-steamer *Mundaka* (of which we gave full particulars in our Launch columns, March issue, page 512), was taken out from the yard of Messrs. Wm. Gray & Co., Limited, West Hartlepool, for her trial trip. She has been built to the order of Senor Ramon de la Sota, of Bilbao, and is the fifth vessel built by Messrs. Gray for the same gentleman. Several runs were made along the coast, with very satisfactory results, the vessel on the conclusion of the trial at once proceeding to Bilbao for her first cargo.

Peareth.—On Thursday morning, April 6th, the large steel screw-steamer *Peareth*, built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, West Hartlepool (of which we gave full particulars in our Launch columns, April issue, page 41), was taken out to sea for her official trials under the command of Captain McKenzie. After the vessel's compasses were adjusted her head was turned seawards, when she made several runs. The speed obtained and the vessel's performance generally was the comment of all on board, the owners expressing great satisfaction.

Pauline.—On April 11th the new steam trawler *Pauline* was taken on her trial trip, which was in every way successful, the vessel steaming 11 knots, and the engines working smoothly throughout. The *Pauline* has been built by Messrs. Eltringham & Co., of South Shields, to the order of the Wear Steam Fishing Co., Limited, of Sunderland. She is to be engaged exclusively in the development of the Sunderland fish trade. The vessel is built of steel to class 100 A1 at Lloyd's. Her dimensions are 96 ft. by 19 ft. by 11 ft. 6 in. Her engines are on the compound surface-condensing principle.

Jabiru.—On April 13th the s.s. *Jabiru*, which has been built by Messrs. Wigham, Richardson & Co , at their Neptune Works, Newcastle-on-Tyne, to the order of the Cork Steamship Co., Limited, of Cork, for their Continental service, sailed from the Tyne. During the day the steamer was at sea, but owing to the bad weather no speed trials could be made, but the machinery worked during the whole time in a manner which gave satis faction to all concerned. The vessel is 260 ft. long by 34½ ft. beam; she is built to attain the highest class in Lloyd's Register, and is fitted with triple-expansion engines. She has also very comfortable accommodation for a limited number of first-class passengers, and is supplied with all the most improved appliances both for handling the ship herself and her cargo. The owners were represented on the trial trip by Capt. Hore, of Liverpool, their marine superintendent, and Mr. J. A. Flockhart, of Liverpool, their superintendent engineer, whilst Captain Dobson took command of the ship on her first voyage. This steamer is the fourth built for the Cork Steamship Co., by Messrs. Wigham, Richardson & Co., and there are two more in hand.

Birker Force.—On April 13th the trial trip of the s.s. *Birker Force* took place, and proved highly satisfactory, a speed of 10½ knots being attained. This vessel was recently launched by the Irvine Shipbuilding and Engineering Co., Limited, Irvine, for the Birker Force Steamship Co., Limited, Whitehaven (of which we gave full particulars in our launch columns, April issue, page 43), and is specially fitted for their coasting and Continental trade.

Claudius.—On April 20th the fine large screw-steamer *Claudius*, built by Messrs. Wm. Gray & Co., Limited, of West Hartlepool, to the order of Mr. C. Andersen, of Hamburg (of which we gave full particulars in our Launch columns, April issue, page 42, and August issue, page 208), was taken to sea for her trial trip. The engines have been supplied by the Central Marine Engine Works of the firm, and have cylinders 25½ in., 40½ in., and 67 in. in diameter by 45 in. stroke. The boilers are three in number, 13 ft. 3 in. diameter by 10 ft. 6 in. long, and work at a pressure of 170 lbs. per square inch. Manganese bronze blades are fitted, a Mudd's evaporator, &c., and the vessel is lighted throughout with electricity. After adjustment of compasses, the vessel and her machinery were put under the usual tests, with very satisfactory results, there being no hitch whatever. The average speed recorded was 11¾ knots.

Hyanthes.—Lately the steamer *Hyanthes*, built by Messrs. Bartram & Sons, Sunderland, for Messrs. R. P. Houston & Co., of Liverpool (of which we gave full particulars in our launch columns, March issue, page 513), has had a very successful trial trip. The vessel is replete with everything that experience can suggest for the safe carrying of cattle as well as general cargo. Cattle stalls of a modern and improved type for about 600 head of cattle are fitted in the 'tween decks, and on the shelter deck, which runs right fore and aft, a very large number of sheep are arranged for. Several high-speed engines and centrifugal fans provide a very extensive system of ventilation throughout the vessel. After the completion of the trial the vessel proceeded to her berth at Glasgow to load cargo for the River Plate.

Rhodesia.—Lately the large steel screw steamer, *Rhodesia* (of which we gave full particulars in our Launch columns, April issue, page 41), left the Wear for her trial trip. She has been built by Messrs. John Priestman & Co., Southwick, to the order of Messrs. John Cory & Co., Cardiff. A heavy sea was running at the time of the trial, but the vessel behaved splendidly, everything working to the satisfaction of all on board. After the trial the vessel went into Blyth to take her first cargo.

Eastern.—Lately the new steamer *Eastern*, built by R. Napier & Sons, Limited, Govan, for the Eastern and Australian Steamship Co., London (of which we gave full particulars in our Launch columns, March issue, page 515), has completed her official trials on the Firth of Clyde, when all the conditions of the contract were fully complied with. The machinery consists of a set of triple-expansion engines, having cylinders 27 in., 45 in., and 73 in. diameter by 4 ft. stroke, with two double-ended boilers for a working pressure of 185 lbs., and fitted with the most recent appliances for efficiency and economy, including Howden's forced draught, bronze propeller blades, &c. The results of the trials were very satisfactory, the contract speed being easily attained, and Mr. Henry Stubbings, who represented the company, expressed himself as highly pleased with the ship and her performance.

M. A. Hanna—On March 29th, the Globe Shipbuilding Co., Cleveland, Ohio, launched the steel propeller, *M. A. Hanna*, *430 ft. long overall.*

Reviews.

Engine-room Practice. By John G. Liversedge, Chief Engineer. R.N. London: Charles Griffin & Co., 1899.

The author of the present volume has designed his work to form, as it were, a counterpart and supplement to that well-known and most useful book, Seaton's "Manual of Marine Engineering." That is to say, he endeavours to avoid treating here of matters with which Mr. Seaton deals, so that there may be as little as possible overlapping between the two books. A general description of the machinery of steam ships is afforded, both main and auxiliary engines being dealt with. An excellent notion of the arrangement of the machinery of a modern vessel is given by illustrations of the engine-room of H.M.S. *Powerful*, one of the two biggest cruisers in her Majesty's Navy. For a list of the numerous auxiliary engines now found aboard steam vessels he gives details of the installations fitted in H.M.S. *Prince George*, a recently commissioned battleship of the first class. This gives an excellent index of the responsibilities of the engineering department in modern days. Then a chapter is devoted to a statement of the conditions of service of engineer officers in the Royal Navy and in the Royal Naval Reserve. Here there are many useful, practical hints which we have never previously seen in print. The same remark applies to the matter of the next chapter, where the treatment just given to the Queen's service is applied to that of leading companies under the Red Ensign. Here special information as to the procedure in the P. & O. fleet is afforded. Information as to the various duties in the engine and boiler rooms, from the time steam has to be raised till the vessel is at her destination and minor repairs have to be effected; the best modes of adjusting machinery at sea and of dealing with breakdowns; the treatment of boilers and of auxiliary machinery; the mode of dealing with the under-water fittings, and with the parts of the hull with which the engineer is concerned, are discussed. A good deal of detail applicable only to the work of naval engineers is afforded. Amongst this may be cited the account of the Temperley Transporter—which is only used (so far as we know) in practice for the coaling of warships at sea—the care of the engines and boilers of small steamboats (which are seldom seen in merchant ships), the air-compressing machinery—which is used only for charging torpedoes—and the management of torpedo-boat destroyers' machinery. But on the other hand there is a good deal of attention paid to the proper management of refrigerating machinery, which as yet is not largely introduced into Queen's ships, though its use there is likely in the future to be greatly extended.

We have very briefly indicated the ground covered by Mr. Liversedge's book. But we have said enough to show that it will be invaluable to the young engineer who wishes to thoroughly understand and efficiently fulfil his duty at sea. It is certainly well up to date, and will be a very valuable memorial in years to come of the position of the marine engineer and the level of his profession at the close of the nineteenth century.

A Practical Dictionary of Electrical Engineering and Chemistry in German, English and Spanish. By Paul Heyne. Dresden: Gerhard Kuhtmann; London: H. Grevel. 1899.

This work is published in three volumes, of which the one before us is the second. The plan of the work is to give in parallel columns words and phrases in the three languages dealt with. Each of the three volumes therefore begins with a different language in the first column, which is the one that gives the alphabetical sequence. That with which we are favoured shows English in the index column, followed by Spanish and German. The work seems thorough and is likely to be of use to engineers and chemists and those who write on the subjects affected. For it is certain that little attention has been given to the provision of works of this character dealing with the Spanish language, though that tongue is so largely spoken by many nations in extra-European countries. There need be no apology for adding the German column, since Germany is nowadays so advanced in all that concerns practical science. The work seems to embrace a very large number of words, and special attention has been given to the rendering of compound words and phrases, which are each set under their catch words. We may certainly recommend the book to those who have business dealings and correspondence with Spanish or German firms.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from March 9th to April 12th, 1899.

5007 F. W. Golby. (H. Maluche, Germany.) Pumping apparatus.
5015 C. Lorenz. Engines.
5020 S. Quincey. Engines.
5032 A. J. Boult. (C. A. Rosier, France.) Steam generators.
5044 J. E. Thornycroft. Fastening condenser tubes.
5152 S. A. Ward. Metallic packings.
5162 T. G. Lord and E. W. Moate. Engine governor.
5165 J. I. Thornycroft. Steam generators.
5171 C. A. Allison. (The Parke & Lacy Co., United States.) Feed-water heaters and purifiers.
5215 J. I. Thornycroft. Water-tube steam boilers.
5237 J. M. E. Riedel and O. F. J. Grahl. Funnels.
5289 M. P. Elgen, C. Rehnstrand, J. J. Moe, and M. Smith. Rotary engines.
5301 R. Whitehead. Valve gear.
5335 J. and A. Andrews. Valves.
5345 J. C. McLardy. Combustion of fuel in boilers.
5390 J. W. Blance. Finding position of ship at sea.
5428 A. G. Walls and C. Henderson. Engine indicators.
5431 J. D. Williamson, jun. Valve for steering gear.
5452 S. C. Davidson. Centrifugal fans or pumps.
5496 A. J. Loftus. Sea charts.
5501 O. F. Leibert. Producing armour plates.
5520 C. K. Pickles and the United States Metallic Packing Co., Limited. Pneumatic chipping hammers.
5525 F. W. Golby. (L. A. Roosen, Russia.) Signalling ships.
5532 W. Kane. Boilers.
5541 W. T. Lord. Pumps for boats.
5582 J. Hallett and G. Halliday. Generators.
5652 J. Allen and J. Wilson. Engine governors.
5679 J. B. G. Lester and J. Peterson. Steam boilers.
5722 J. Stradling and E. P. Plenty. Starting gear.
5798 A. Purvis and W. Harbinger. Metallic packing.
5799 A. Purvis and W. Harbinger. Metallic packing.
5851 J. Duthie. Sails.
5861 H. S. Cummings. Rotary engines.
5870 W. H. Wright. Propeller-shaft bearings.
6877 F. L. Lane and the Leeds Forge Company, Limited. Flanging dies.
5878 E. Gearing. Steam boiler furnaces.
5881 C. A. Parsons and A. D. Wass. Steam turbines.
5910 J. J. Royle and J. Glover. Guard for gauge-glass fittings.
5938 W. W. Smith. Anchors.
5949 E. Gearing. Steam boiler furnaces.
5955 C. E. Roussel. Automatic steering mechanism.
5965 J. Southall. Internal combustion engines.
5977 S. S. Walker. Tubes for multitubular boilers.
5997 F. Hudson. Steam and hand derrick cranes.
6031 C. L. Burger. Marine vessels.
6040 H. B. Lundstrom. Indicating leaks in ships.
6041 W. H. Burgoin. Course correctors for ships.
6087 W. E. Philbrow. Internal combustion engines.
6100 F. Lobnitz. Lubricating steamship propeller shafts.
6102 R. C. McCunn. Guards for ships' tables.
6121 O. T. Earle. Steam generator.
6135 R. J. O'Neill. Boilers.
6146 J. O. Elliston. Pumps.
6155 F. W. Jones and E. W. Thurgar. Ships propelled by steam power.
6156 C. V. Suppan and B. Szendi. Steering gear.
6168 W. F. Balls. Marine engine governors.
6196 W. Gibb and R. Chambers. Lifeboats.
6198 E. F. Gorman and P. F. Yost. Submerged feathering propellers.
6209 J. R. Browne and J. A. Baker. Breakwaters.
6212 J. Baird. Rotary engine.
6223 J. Day. Compound internal combustion engines.
6225 Kirkham, Hullet & Chandler, Limited (F. Marshall, Denmark). Condensers.
6256 A. S. F. Robinson. Engine governors.
6262 A. Boyd. High-speed engines.
6266 H. W. J. Cheffins. Cranes for dredging.
6284 A. E. Muirhead. Packing.
6227 J. Hewetson and J. R. Fryer. Engine governors.
6301 J. Prestwich. Valves.
6326 W. H. Newman. Variable speed gear.
6335 M. Gehre. Producing electric current at sea by action of the waves.
6337 E. J. Smith and J. Barber. Indicating when marine engines are moving.
6351 M. & A. Dulac. Elastic packing rings for flange joints.
6354 P. Brotherhood. Centrifugal governors.
6370 E. B. Smith, W. H. and E. Asquith. Valve.
6376 E. R. Billington. Collapsible berths for ships.
6393 J. B. Bowie. Propellers.
6394 J. T. Hayes. Preventing boiler explosions.
6431 P. J. Keene. Boilers.
6440 H. Barcroft. Internal combustion motor engines.
6454 J. Cowan. Water-tube boilers.
6508 E. Andersen. Alarm apparatus for boilers.
6512 W. Parratt and H. Marsh. Tool for expanding tubes.
6595 J. Y. Johnson. (The Wellman Seaver Engineering Co., United States.) Cranes.
6596 L. Roper. Deck seats for use on ships.
6597 L. Roper. Ships' davits.
6616 W. Pepper. Steam engine valve.
6638 F. E. Rickman and C. A Hawthorn. Valves.
6652 R. Webster and C. H. Marshall Steam engines.
6656 P. M. Justice. (The Marsden Co., United States.) Material suitable for engine packing.
6720 J. Thornycroft. Boilers.
6751 P. R. J. Willis. (J. Holt, United States.) Propelling boats.
6759 E. Foden. Controlling steam engines.
6763 J. Lyall. Covers for screw propeller shafts.
6778 J. Grigg. Automatic water-tight valve.
6784 J. I. Booker. Steam boiler furnace flues.
6803 Sir W. G. Armstrong, Whitworth, & Co., Limited, and L. Newitt. Winch gear for hoists.
6811 R. J. Smith. Stop valve for steam boilers.
6824 W. Waller. Fittings for glass tubes of water gauges.
6829 J. Gwynne and E. B. Sargeant. Centrifugal pumps.
6831 J. A. & S. Fletcher. Valves for steam boilers.
6832 T. J. Codd. Non-return valves for steam fittings.
6835 A. E. Preston. Movable keels for yachts.
6856 T. Downie. Metallic piston packing ring.
6885 J. Igert. Multitubular steam generator.
6891 W. E. Pott. Water level indicators.
6897 A. J. Boult. (M. P. Boss, United States.) Water-tube boilers.
6913 E. D. & E. C. Meier. Securing manhole plates of boilers.
6951 O. Imray. (A. Shaw, United States.) Piston packing.
6961 G. Lluch. Means for manœuvring a vessel.
6985 S. E. Alley. Steam engines.
7007 R. C. Ayton. Internal combustion engines.
7015 S. A. Varley. Telegraphing by sound waves.
7043 W. P. Little. Rotary engines or pumps.
7048 W. C. Smith. Couplings for shafting rods.
7049 J. Cunningham. Working steam trawl gear.
7057 G. H. Carr and I. N. Fitzpatrick. Steam engines.
7074 E. Howl and W. W. Attwood. Pumping engines.
7089 M. F. Mithoff. Navigable vessels.
7091 Tangyes, Ltd., and J. Robson, jun. Speed gear.
7096 O. Jull. Continuously vertical paddle-wheels.
7098 A. L. Schram. Gauges.
7106 G. Bourton. Rotary engine.
7110 W. H. Wheatley. (La Societe Generale des Aciers fins, France). Process for manufacturing steel.
7145 F. Lange and H. Behman. Screw propellers.
7150 R. W. Thompson. Ship.
7158 W: Haddock. Rotary engine.
7170 J. M. Hagg. Packing for journal bearings.
7177 A. E. Gibson. Armour plating.
7185 E. D. Wassell. Process of annealing steel.
7191 E. Lindemann. Reducing friction in ships.
7192 W. D. Priestman and H. Richardson. Grab dredgers.
7205 J. Aylward. Engines.
7211 R. R. Taylor. Engine governor.
7228 R. Franklin: System of ventilating ships.
7245 L. A. V. Schie, and F. & T. J. Bezemer. Rotary engines.
7258 J. Delin. Frictional driving gear.
7260 S. Ling and W. Robbens. Trawl nets.

7275 H. Kirschning and F. Altschwager. Packing for stuffing-boxes.
7329 F. C. Church. Anchors.
7330 S. Davies. Driving gear for machinery.
7393 R. F. Hall. Internal combustion engines.
7410 W. Kelchon and J Mason. Ascertaining the weight in ship loading
7418 E. Bennis. Boiler furnaces.
7430 O. M. Hofwolt. Expansion slide valve gear.
7435 W. Pett. Pneumatic boat belt.
7454 W. H. Wise. Derrick swinging gear.
7462 W. Ambler. Steam generators.
7485 C. Griffin. Rotary engines.
7486 E. H. Weatherhead. Hydraulic engine and pump.
7493 A. Blowey. Lowering boats..
7509 E. Guerrier. Internal combustion engine.
7528 E. H. Montgomery. Rotary engines.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class; 2C Second Class.

March 25th, 1899.

Abraham, T. A.	1C	Cardiff
Adamson, Rt. T.	1C	N. Shields
Allan, Wm.....	1C	W. Hrtpl.
Anderson, W. P.	2C	London
Bowen, David..	2C	Liverpool
Boyle, Wm.....	2C	Glasgow
Browne, Lindsay	1C	Cardiff
Bruce, Thomas	2C	,,
Carter, George	1C	N. Shields
Cooper, Chas. S.	2C	W. Hrtpl.
Davies, Griffith	2C	Liverpool
Davies, John S.	2C	W. Hrtpl.
Devlin, Peter S.	2C	Liverpool
Douglas, Jas. R.	2C	Cardiff
Duncan, R. A. S.	2C	,,
Evans, Charles	1C	,,
Forbes, Robt. A.	2C	Dundee
Gordon, Thos...	C2	Glasgow
Grieves, Geo. E.	1C	London
Hall, Charles ..	1C	Cardiff
Hall, Thomas ..	1C	W. Hrtpl.
Hornby, Edgr. J.	2C	Liverpool
Hughes, Jhn. M.	1C	,,
Hughes, Richrd.	1C	Cardiff
Jones, William	1C	Liverpool
Mackintosh, G.D	1C	Glasgow
M'Cann, Jsh. H.	1C	Liverpool
Metcalfe, Hy. C.	1C	W. Hrtpl.
M'Farlane. Jas.	2C	Liverpool
Moloney, David	1C	Cardiff
Muir, David Y.	1C	Glasgow
Nelson, Frck. F.	1C	London
Nicholson, T. H.	2C	W. Hrtpl.
Oliver, John G.	1C	,,
Parker, George	2C	Cardiff
Parker, Robt. G.	1C	W. Hrtpl.
Pitt, Edwd. W.	1C	London
Rae, Wm. A. ..	2C	N. Shields
Rogerson, Bnjm.	2C	W. Hrtpl.
Russell, Harper	1C	Glasgow
Santos, E.	1C	London
Sharp, Edwd. S.	1C	N.Shields
Smith, George .	1C	Glasgow
Stephenson, H.	2C	Cardiff
Stevenson, A...	1C	Liverpool
Stobbie, George	2C	Dundee
Sturrock, Jas. A.	2C	,,
Sutton, Wm. G.	1C	Sthmptn.
Walker, James	1C	Glasgow
Watson, Wltr. E.	1C	W. Hrtpl.
Williamson, P.R.	2C	Liverpool
Zeale, Richd. T.	2C	Cardiff

April 1st.

Aiken, James	2C	Sun'rland
Banks, Albert	1C	N.Shields
Birrell, Wm.	2C	Liverpool
Chapman, W. F.	2C	London
Chouvaldjy, N.	2C	Liverpool
Christie, Jhn.C.	1C	Aberdeen
Clark, Chas. J.	2C	N.Shields
Clark, James	1C	Aberdeen
Cramman, Wm.	2C	N Shields
Elliott, John	1C	Liverpool
Gallon, John	2C	London
Gray, Jas. A.	1C	Liverpool
Harle, Ralph Y.	2C	N.Shields
Hibbins, Hy. U.	1C	Bristol
Hutchison J. Mc	1C	Liverpool
Ingram, D. B.	2C	N. Shields
Jack, John ..	2C	Aberdeen
Jobling, T. L.	1C	N.Shields
Johnson, H. L.	2C	Sun'rland
Jones, H. H.	1C	Liverpool
Lee, John ..	2C	N.Shields
Linton, John ..	12C	,,
MacDonald, N.	2C	Liverpool
Mackie, Hy. J.	1C	Hull
McIntosh, L. ..	2C	London
Miller, George	1C	Liverpool
Milne, Wm. A.	2C	Aberdeen
Morrice, A. W.	20	,,
Morrison, J. D.	1C	London
Murray, James	1C	Aberdeen
Price, Thos. W.	2C	Liverpool
Quack, E. A. ..	1C	,,
Richardson, W.	1C	Aberdeen
Thomas, R. P.	1C	Liverpool
Thomson, J. G.	1C	London
Whiteley, J. H.	1C	Liverpool
Whittingham, G	1C	N.Shields
Wilkinson, W.B.	2C	Liverpool
Winton, John ..	2C	Aberdeen

April 8th.

Adamson, W. J.	1C	Glasgow
Aitchison, Thos.	2C	Liverpool
Ambler, G. H...	2C	Cardiff
Barr, Duncan ..	2C	Glasgow
Barrow, A. J. ..	2C	London
Best, Thos. H.	2C	,,
Brown, C. G. ..	2C	N.Shields
Bulman, W. ..	2C	Cardiff
Cameron, A. ..	2C	Glasgow
Cockayne, W...	1C	Liverpool
Common, W. ..	2C	N.Shields
Davies, John ..	1C	Cardiff
Davies, T. H. ..	2C	Liverpool
Dorman, J. P.	2C	N.Shields
Dunlop, H. J. L.	20	Belfast
Gemmell, John	2C	Glasgow
Gilby, N. W. ..	2C	London
Greenman, R. H.	1C	Cardiff
Hamilton, John	2C	Glasgow
Hunter, John ..	1C	N.Shields
Inman, James..	2C	Cardiff
James, Geo. P.	2C	,,
Jeans, Alfred ..	2C	N.Shields
Jones, Thos. M,	2C	London
Lazzari, Joseph	2C	N. Shields
Lees, Robert C.	2C	Glasgow
Mace, Jas. H. ..	2C	N. Shields
Miller, Robt. M.	2C	Glasgow
M'Luckie, A. ..	1C	Cardiff
Noble, Henry C.	1C	N.Shields
Paterson, Wm.	2C	Cardiff
Paull, John A.	1C	Glasgow
Prichard, David	1C	Cardiff
Robertson, A...	2C	,,
Robertson, C...	1C	Glasgow
Schmidt, E. F.	2C	London
Scivill, Wm. D.	1C	Cardiff
Smith, E. C. ..	2C	London
Smith, S. H. ..	1C	Liverpool
Stent, Chas. E.	2C	,,
Stirton, Alexr.	2C	Glasgow
Taylor, Benjn.	2C	N.Shields
Terney, C.	1C	Liverpool
Thompson, E...	2C	N.Shields
Wallace, L. L...	1C	Liverpool
Webster, R. J...	1C	Glasgow
Williams, David	2C	Liverpool
Williams, G. T.	1C	Cardiff
Williams, John	2C	,,

April 15th.

Anderson, Thos.	2C	Greenock
Batchen, D. M'K	1C	,,
Beedie, Wm. D.	2C	,,
Boorman, A. ..	2 C	London
Bull, Percy A...	1C	,,
Changaratos G.	2C	,,
Garden, Robt. ..	1C	Leith
Gibson, Robt...	2C	,,
Grant, Andrew	2C	Greenock
Grindlay, G. J.	2C	,,
Hunter, Alex ..	2C	Liverpool
Inverarity, D.C.	2C	Leith
Lewis, Robt. H.	2C	Greenock
Martin, Wilfrid	1C	Liverpool
M'Kinlay David	2C	Greenock
Murphy, Rd. H.	1C	Liverpool
Paterson, E. ..	2C	Greenock
Rae, George ..	2C	,,
Ross, Jas. G. ..	2C	Leith
Roughton, H...	2C	London
Scott, A.	2C	Dublin
Segreave, Wm.	2C	Liverpool
Sivyer. F. J. J.	1C	London
Thompson, S. F.	2C	Liverpool
Wood, Thos. ..	2C	London

Water-tube Boilers in the German Navy.—A German engineer, writing on the subject of the systematic trial being given to the several systems of water-tube boilers in the German Navy, observes that it is premature as yet to pass positive judgment upon any one of them, but as far as the experiments have gone the following results may be noted. First of all as to the Thornycroft system. This has been applied to the coasting ironclad *Aegir*, which has been making trial trips for fully half a year and has further taken part in the autumn manœuvres, and the system has come out very well under the test. For instance, it has been shown that with the engineering staff working at forced pressure, it is possible to get up steam in at least 25 minutes—a very remarkable achievement, which quite puts the locomotive and other boilers of that type into the shade. Also, the trial has shown many apprehensions which were expressed as to the advisability of adopting the Thornycroft boiler to be groundless. Particularly striking is the saving in weight of this system in comparison with that of the locomotive boiler system on the sister ironclad, the *Odin*. The total weight of the boilers on the latter stands at 105 tons, as against 68 tons on the *Aegir*, while the weight of the *Odin's* boilers, ready for use, is 239 tons, as compared with only 190 tons on the *Aegir*, and the *Odin* again has to carry 49 tons of water in her boilers, whereas 23 suffices for the *Aegir*. These proportions are still more striking in the case of the new ships of the line and the cruisers. On the former the saving of weight effected by the employment of one-third water-tube boilers amounts to 140 tons, and where these boilers have been wholly adopted on the large cruisers the saving is as much as some 280 tons. The reason, the writer remarks, why the tubular boilers have only been partially adopted on the new ships of the line, as in the case of the *Fürst Bismarck*, is that the heavy battleships as a rule only travel at a reduced speed, for which the one-third tubular boilers would be quite sufficient in the very shortest time to develop the required propelling power. The German system of tubular boilers, that of Durr, has also given satisfactory results as far as the trial trips of the *Baden*, *Baiern*, and *Victoria Luise* have shown, and if certain improvements in it which have been taken in hand are succeeded with, then, it is declared, its future will be assured. Others of the fleet equipped after this system of boiler are the big cruiser *Vineta*, and the ship of the line *Sachsen*. The Belleville system has so far only been tried on the two big cruisers *Hertha* and *Hansa*. This class boiler is somewhat heavier than the Durr, and entails a bigger consumption of coal. The *Hertha*, which is the biggest cruiser fitted up on the Belleville system, developed on her trial trip 10,173 H.P., while the *Freya*, with the Niclausse boiler, developed 10,226 H.P., and the *Victoria Luise*, with Durr boilers, 10,863 H.P. Further trial trips, which are to be made during the summer, are expected to give more definite results.

The Marine Engineer.

LONDON, JUNE 1, 1899.

WE have before us a terse but very emphatic statement of the present disabilities and unjust disadvantages meted out to the engineering branch of the Royal Navy. These disadvantages, and causes of dissatisfaction are, briefly, that engineer officers are still classed as a civil branch of the Navy. They have no executive control in their own department, cannot award even minor punishments, and cannot sit on courts-martial when an officer or man of the engine-room department is on trial for departmental offences. Age for age with the executive officers, their *quasi* rank is utterly disproportionate, considering also their great responsibilities. The number of engineer officers in the highest rank to which they are permitted to attain is also disproportionate, as is also their pay on promotion, and their retention beyond the age of 50, seeing that the wear, tear, and close confinement of their profession is more exhausting than in the case of deck officers. There is no representative of the engineering department upon the Admiralty Board, although representing one-third of the total *personnel* of the Navy, and responsibilities in connection with nearly the whole of the *matériel*. The engine-room complements are too small to meet the stress of actual warfare, or the losses that may then occur. No writers are allowed to the chief engineers, and no re-engaging pay is given to stokers as to seamen. The obvious remedy for most of these evils is that the naval engineers should be recognised as a Royal Military Corps as much as are the Royal Engineers or Artillery of the army. It is possible to imagine a battle on land without engineers being called upon for services, but it is impossible to imagine a battle at sea without the main executive responsibilities lying with the engineering department. In such case the chief engineer should be granted rank as vice-admiral, and commanders, captains, and lieutenants should bear a similar ratio to the *personnel* of the engineering department as in the executive department. It is pleasant for us to be able to record that at least one vice-admiral of great popularity of the present day—viz., Lord Charles Beresford, who is wont to boldly express his opinions —has endorsed this view at a public dinner, *i.e.*, that of the Institution of Mechanical Engineers, that he, at least, would be glad to see the Engineer-in-Chief and the Chief Constructor of the Navy honoured with the rank of vice-admiral. Even so far back as 1876 the committee presided over by the late Admiral Sir A. Cooper Key recommended "that the engineer officers should be classed with the executive or military branch." If such a change were necessary then, how much more so is it at the present day? The Americans have led the way, and grappled with the difficulty in a far more drastic manner than proposed above, and are about to absolutely amalgamate both departments of the service, so that an executive, or fighting, officer must be prepared to do duty either on the bridge or in the engine-room. Why not? Engineer officers of the army have shown themselves —particularly in these latter days—splendid generals, with a gift for organisation and attention to material, transport, and details that goes far now to ensure success. How much more would that be the case where the absolute fighting material is, as the First Lord of the Admiralty expressed it, a floating museum of machinery. With such strong advocates in the highest governmental and executive branches of the Navy for the recognition of the importance of the naval engineer as a fighting officer, the reforms demanded cannot be long in coming.

AGAIN we have to deplore a serious disaster to an Atlantic liner, the ill-fated *Paris*, though, fortunately, unaccompanied with loss of life. The stranding of this vessel upon the Manacles Rocks, within a stone's-throw of the foundering of the *Mohegan*, has given a further notoriety to this dangerous point of coast, and at the same time has increased the bewilderment as to how such well-found and appointed vessels can find themselves so far from their proper course as to run stem on to the British coast. Where the course is, as it was, from Cherbourgto New York, one would have thought that there was sufficient room in the English Channel to enable steamers, not prevented from lying any predefined course by stress of weather, to keep clear at least of fouling the British coast. The succession of accidents upon these rocks has given rise to old traditions that the rocks about this part of the Cornwall coast are magnetic, and serve to produce deviation of the compass. But we fear that there are other possibilities of deviation from a supposed course in misty weather, where so much is left to dead reckoning, that will serve to explain the disasters of the *Paris*, the *Mohegan*, and the *Stella* without falling back upon traditional magnetic rocks serving to remind one of the voyages of Sindbad the Sailor. Where a course is set obliquely across the English Channel the tide, whichever way it is running, must serve to produce considerable leeway; and should such tide be abnormal in velocity or time of running, as may easily on occasion occur, the extra leeway in a long board may easily produce an error of some miles in the point of arrival. In the case both of the *Paris* and the *Mohegan* the Lizard was evidently the point aimed at, though from different points of departure;

and it would appear that long experience of the average accuracy of dead reckoning by the course set and the miles run, or the revolutions of the engine noted, are apt to breed a confidence as to position that abnormal circumstances may completely upset. We still want a warning instrument of the near approach of coast or other obstacle if such an apparatus can be devised. If not, nothing can replace the precautions necessary in thick weather to ascertain from time to time the possible position of a vessel, always to be taken on the assumption that she may be considerably out of her supposed position by mere dead reckoning.

WE are glad to see that the Institute of Marine Engineers is successfully doing the paramount duty of such an Institute in providing to its members and, through them, to the general engineering public, information, embodied in papers communicated to it, which will add largely to the scientific and practical knowledge of marine engineers, constructors, and naval architects. This has been particularly exemplified by two papers communicated to the Institute on May 8th. The first of these was that by Mr. J. T. McArthur, entitled, "A Comparison between the Performances of two Steam Ships." Although this paper was comparatively short and very modest in its tone, as perhaps befitted the scanty ground covered by the two comparisons given, yet this paper marked an epoch in the Institute, inasmuch as it gives to the shipmasters, engineers, naval architects, and all interested, comparative results in the two ships as actually obtained at sea. It only requires that these comparisons and records should be multiplied by the only men who have an opportunity to do so, viz., the sea-going engineers, to accumulate most important evidence as to results, which should bear good fruit in guiding the united efforts of constructors and engineers in producing the most economical steamers possible. In the present instance the summarised results of the two vessels in form of coal consumption per ton carried per mile show such surprisingly different results in the two vessels, that the one becomes a model to imitate, and the other one to avoid. When, however, it is found that the tonnage and dimensions are considerably different and also the indicated horse-power—whilst in one a dynamo producing 5,000 watts was driven, and in the other there was no dynamo at all—the startling fact that one steamer required more than a third more consumption of good Welsh coal per ton carried per mile loses somewhat of the lesson that may be deduced, from the difficulty of determining in what special points the loss of the worse vessel occurred. Probably the loss was an aggregation of deficiencies on all points, from the lines of the hull to the conditions of the working of the boilers by a certain amount of mismanagement in having allowed caking and deposit in the boilers, from excess of engine oil passed through the high-pressure cylinder. The conditions of coolness and comfort in the stokehold and engine-room, and dust in the latter, in the worst of the steamers, may in themselves have had a good deal to do with the worse conditions of economical stoking in that steamer. And as was remarked by the Chairman, it was not to be expected that there could be much economy in a ship in which there had been three chief-engineers in four years. Whatever the drawbacks of the particular comparisons given, as leading to any accurate deductions, we would again emphasise that the paper indicates a line of information which no Institute but that of the Marine Engineers can be so fitted to give; and of which the importance, when comparisons, if always carried out on the same basis, have become numerous, cannot be too highly estimated. By all means let us have some more of such comparisons.

A PAPER of much higher ambition, and one that, as a matter of research, would be a credit to any of the older and longer established technical institutes, was that communicated by Mr. Halliday, on "Experiments on the Heat-Absorption Power of Water," with a view of ascertaining the effect of the speed of water circulation in the absorption of heat. It must be remembered that the various devices once adopted by engineers to accelerate and determine the circulation of water in boilers have much been discounted by the experiments of Mr. Yarrow, by which it appeared that, water readily determines its own path of circulation, and will as readily circulate downwards as upwards in a tube subjected to the impact of heat. Mr. Halliday now presents the other point of view, that however the direction of circulation may be determined or may determine itself, the speed of such circulation over a heating surface is of vital importance to the quantity of water heated in a given time and to the amount of heat units thus absorbed. From the experiments carried out by Mr. Halliday with constant application of heat to a flowing stream of water, the velocity of which may be regulated, it undoubtedly appears that there is a point of maximum velocity up to which the absorption of thermal units by a flowing stream of cold water steadily increases, though the actual temperature of the resulting heated volume of water will naturally decrease. Beyond such maximum velocity the amount of absorption of the thermal units decreases. This is a curious result, which requires some thought and investigation, in order to determine the best velocity of water over a heating surface so that it may, in a given

time, absorb the greatest quantity of thermal units from a given source of heat. As thermal units are the product of two factors—the mass of water heated, in a given time, by the rise of temperature in the mass—the problem would appear analogous to the problem of the maximum condition of effective work units from a water wheel, turning with the flow of the water, where the work units are the product of effective pressure upon the wheel into the velocity in a given time with which that pressure overcomes a similar resistance. As the effective pressure upon the wheel also reduces as the speed of the wheel increases, it will always be found that there is one particular velocity of the wheel relatively to the flowing or falling water at which the wheel effects the maximum working effect. There appears to be some analogy; but in Mr. Halliday's heat experiment, though the water is there, which is the wheel?

The four torpedo-boat-destroyers built last year by the firm of F. Schichau, in Elbing, for the Imperial Chinese Government, made on their trial trip in free open sea a mean speed of 35 to 37 knots per hour, unattained hitherto, they proved their great sea capacity. All the four destroyers have steamed from Elbing through the Baltic, the German Ocean and Biscay around Gibraltar, through the Mediterranean Sea to Port Said, having run the way from Port Said to Colombo on a stretch without touching the port of Aden, a distance of 3,550 sea miles (about 4,100 statute miles), in quick, irreproachable passage. The destroyers had, after their arrival at Colombo, a large quantity of coal on board; this is a new great triumph for the economy of coals of the Schichau engines, and Schichau has splendidly solved the difficult problem to build such small vessels with a radius of efficiency of 3,000 to 4,000 sea miles. All the four destroyers continued their voyage to Northern China from Colombo after two or three days' rest. Hitherto, the voyage of the four destroyers has been going on without any interruption and without the least delay, as well as with the very least repairs to the engines and boilers.

EXPERIMENTS ON THE HEAT-ABSORPTION POWER OF WATER.

THE following paper is an account of experiments carried out by Mr. G. Halliday in the Institute of Marine Engineers to ascertain the heat-absorption power of water at different temperatures and different velocities across the surfaces:—

The apparatus (Fig. 1) consists of a glass vessel H with a spiral tube sealed into it. Water flows from F through the spiral tube and out by L into the cubic centimetre measure G. The quantity of water flowing through the tube can thus be determined. Steam is generated in the flask D, and flows through the copper spiral C, where it becomes superheated, and flowing into H heats the water as it flows through the coil. The temperature of the water as it flows in the glass vessel H is measured by a thermometer at B, and its temperature as it emerges from the coil is measured by a thermometer at A. The water then flows through L into G, and the number of thermal units given to the water as it flows through the coil J can be determined.

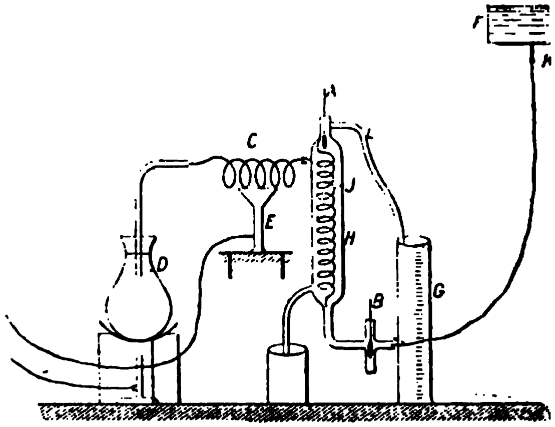


Fig. 1

At first a small copper tank was used between the thermometer B and the source of water. This tank was utilised for raising the temperature of the water before it reached the glass coil. It was found, however, that this arrangement of heating the water before it reached the glass coil did not give constant temperature, as the following results show.

The experiments were made to determine what influence the rate of motion through the tubes had on the water. It will be observed that the quantity of water flowing through the glass spiral J was 5 cubic centimetres per minute. The difference of temperature in the first case was 45·16 deg. Fahr., and in the second case 43·06 deg. Fahr. The times and quantities of water flowing through the glass coil J were taken at the end of each minute.

A.

Experiment when water flowed through the Coil at an Average Rate of 5 Cubic Centimetres per minute.

Time.	Quantity of water in c.c. measure.	Temperature of water when it emerged.	Temperature of water at entrance.	Difference of temperature.
4.39	705	154	109	45
4.40	710	158	106	52
4.41	720	163	107	56
4.43	725	155	107	48
4.44	730	161	106	55
4.45	735	147	106	41
4.46	738	136	106	30
4 47	740	139	105	34
4.48	749	148	104	44
4.49	752	151	104	47
4.50	760	151	102	48

Mean quantity of water flowing per minute, 5 cubic centimetres; average difference of temperature, 45·16.

B.

Time.	Quantity of water in c.c. measure.	Temperature of water at outlet.	Temperature of water at entrance.	Difference.
5.7	40	180	135	56
5.8	68	182	134	48
5.9	91	182	134	48
5.10	118	182	134	48
5 11	149	182	134 5	48
5.12	172	183	135	48
5.13	192	184	137	47
5·14	218	178	139	39
5.15	239	173	140	33
5.16	256	172	140	32
5.17	270	174	140	34
5.18	282	175	136	39
5.19	300	175	134	41
5.20	312	175	132	43
5.21	330	175	131	44

Mean quantity of water flowing through in cubic centimetres, 20·7; average difference of temperature, 43·05.

	Quantity of water per minute.	Thermal units per minute.
In Experiment A.	5	225
In Experiment B.	20·7	891

The source of heat for the generation of steam and heating the coils remained the same throughout. The mean difference of temperature was about the same in each case. The increase of the number of thermal units which were taken up by the water when moving at the high velocity is very marked.

In the next set of experiments the water was led directly from the tank F to the thermometer B. When it was led through the small heating boiler the flow was somewhat intermittent, due to air getting into the boiler. There was also some trouble with the arrangement of the thermometer for taking the temperature of the water as it issued from the spiral. In the new arrangement the thermometer was directly inserted in the end of the glass spiral, and the fluctuation of the thermometer was then the fluctuation of the temperature of the water as it came out of the spiral. One set of readings will show the steady nature of the temperature which came from the tank under the new conditions.

C.

Time.	Quantity of water in c.c. flowing per min.	Temperature of water at A.	Temperature of water at B.	Difference.
3.0	610	140	52	88
3.1	620	131	52	79
3.2	640	136	52	84
3.3	665	137	52	85
3.4	680	141	52	89
3.5	700	143	52	91
3.6	720	143	52	91
3.7	740	143	52	91
3.8	760	141	52	89
3.9	780	135	52	83
3.10	800	142	52	90

Average c.c. flowing through per minute, 19; average difference of temperature, 86·2.

Thermal units per minute given to the water = 1637·8.

The result of this set of experiments, arranged in order of the velocity of water flowing through the tube, is as follows:—

D.

Average quantity of water per minute, c.c.	Average difference of temperature.	Thermal units per minute.
9·2	150·6	1388
19	86·2	1687
32·2	147·9	4759
47·7	39·5	1884
49·4	86	4278
84·5	52·6	4445

In this set of experiments there was considerable variation of the heat applied to the steam superheater and generator, and the result shows considerable fluctuation.

In the next set of experiments the heat of the gas generating steam and superheating was kept constant. The result of the sets of readings, arranged in order of the speed of flow through the spiral, is:—

E.

Average quantity of water per min, in c.c.	Difference of temperature.	Thermal units per minute.
7·2	152·1	1095
10·55	151·5	1606·5
15·5	118	1829
20	88	1760
30	61·7	1851
47·4	37·7	1786·9
61	32	1952
61·3	28·5	1746
75·5	30·8	2325
89·1	26·6	2370
91·6	24·9	2280
150	16·4	2460

Two trials were made with the gas at the generator and superheater, the same throughout the experiments.

F.

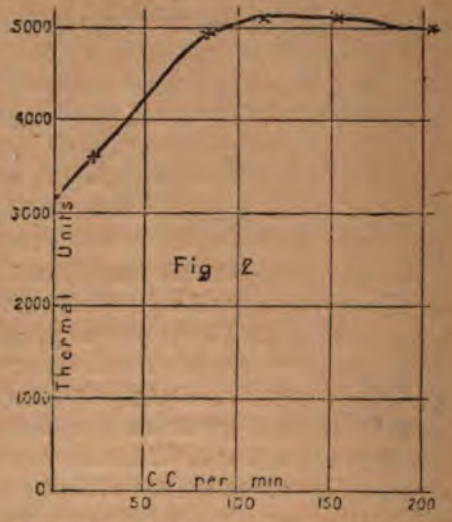
Average quantity of water per min. in c.c.	Average difference of temperature.	Thermal units taken up by water per min.
23·5	74·4	1748·4
120·8	20·3	2452·2
144·1	17	2449·7

The steam was afterwards generated very rapidly and super heated, and the following results were obtained:—

G.

Average quantity of water per min.	Average difference of temperature.	Average thermal units per min.
24	152	3648
81·2	60·6	4920
118	43·2	5123·5
160	32	5120
210	23·8	4998

It will be seen from the two last deducted results that there is a maximum coefficient of transmission of heat. This is also shown in Fig. 2, where the abscissæ represent the velocities of the water and the ordinates represent the thermal units absorbed by the water flowing through per minute. In Table F the middle one is the higher number, and the third from the top is the highest in Table G. It is also to be noted that the numbers of thermal units in Table G are much higher throughout than in Table F. This is in consequence of greater heat being used for generating steam and for superheating. This would appear to show that with this apparatus and with a certain heating arrangement there is a speed at which the maximum quantity of heat is taken in by the water. At a lower speed than this there is less heat taken in, and at a higher speed there is less heat taken in per minute per unit of heating surface.



The next set of experiments was made to determine whether water more readily absorbed heat at the point of ebullition than it did at lower temperatures. In a statement made by Professor Ser, he says, "When the water has come to the boiling point the movements are more than ordinarily tumultuous, and the transmission—of heat—is notably increased." It was sought to determine by the following experiments whether this notable increase of heat given to the water was due to its more rapid motion over the heating surfaces in consequence of the more rapid circulation, or was due to a change in the nature of the water which made it more readily take in more heat.

To do this, the water was made to travel through a straight tube instead of a spiral, in order that the bubbles of steam might rise quite freely. The tube was surrounded as in the last case. At first this surrounded barrel was only 12 in. long, but with as strong heat as possible the water could not be got to rise to the temperature of 212 deg. A longer jacket was then fitted on and carefully covered with asbestos, and strong heat supplied both in the generation of steam and superheating. The water began to boil quite freely, and the thermometer stood at 212 deg. The record of the experiment is given below :—

H.

Time.	C.c. of water per minute.	Temperature at outflow.	Temperature at inflow.	Difference of temperature.
2.39	435	211	55	156
2.40	450	212	55	157
2.41	465	212	55	157
2.42	480	212	55	157
2:43	500	212	55	156
2.44	515	211	55	156
2.45	535	211	55	157
2.46	555	212	55	157
2.47	575	212	55	157

Av. c.c. per min. 17·5 Average difference of temperature 155·4
Thermal units per minute .. .. 1787·1

The water was afterwards made to flow a little faster, while everything else remained at about the same. The temperature stood about 197 deg. Fahr. at the outlet, so that the loss by radiation would be about the same in both cases. Steam was supplied at the same rate and superheated without alteration. The result of the experiment was as follows :—

I

Time.	C.c. per minute.	Temperature of outflow.	Temperature of inlet.	Difference of temperature.
2.51	35	195	53	142
2.52	65	197	53	144
2.53	95	200	53	147
2.54	125	195	53	142
2.55	155	196	53	143
2 56	190	197	53	144
2.57	220	197	53	144
2.58	245	197	53	144
2.59	275	197	53	144
4.00	305	197	53	144

Aver. c.c. per min. 30 Average difference .. 143·8

The number of thermal units transmitted to the water per minute is 4314, as against 1787 when the water was at the boiling point.

The difference of the conditions in the two cases is the more rapid motion of the water through the tube, and it appears that the coefficient of transmission derives more advantage from quick motion over the heating surfaces than from the new properties in the water at the boiling point.

Keeping the heating arrangements the same, a series of experiments was made with this apparatus to determine the effect of the velocity of the water, with the following results :—

J.

C.c. per minute.	Average difference of temperature.	Thermal units transmitted to the water per min.
36·5	129 4	4684
77·5	67·8	5254·5
106 2	51·4	5458·6
135	40·2	5427
175	26·2	4585
205	13·4	2747

Here again there is a maximum transmission when the flow of the water is a little over 100 cubic centimetres per minute—see Fig. 3.

There was a fear that the bubbles of steam as they rose to the surface of the water in the tube would condense in the overflow tube, making the water in it at a higher temperature than when it was sent away under the boiling point. So the temperature of the water was measured as it flowed from the tube into the cubic centimetre measure.

It will also be noticed that the experiments made by Professor Ser, MM. Thomas and Laurens, and other experimenters did not make provision for the separation of the circulation factor from the factor provided by the new properties of the water at the boiling point. In one case there was a pot with a steam jacket underneath it, and the water was boiled in this. In the other case the water was heated with steam passing through a spiral tube placed in the pot; when ebullition began, rapid circulation took place, due to the entraining action of the steam bubbles.

In the apparatus (see p. 99) the circulation produced by the entraining action of the steam is done away with, and only the new properties gained by the water at the point of ebullition remain to increase the heat-absorption power of the water.

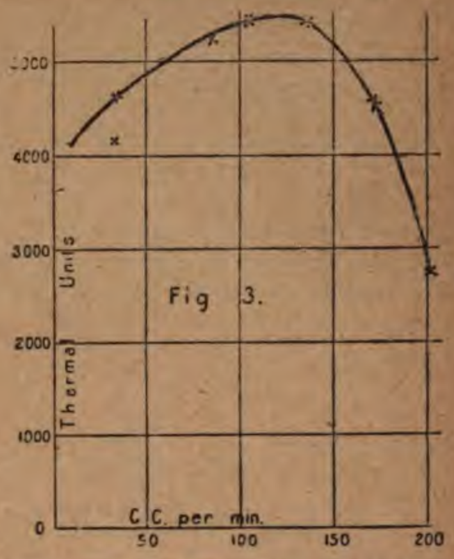


Fig 3.

It may also be pointed out that the condition of water when bubbles of steam are forming and mixing with the water does not appear to improve its heat-absorption power. Here, any way, are the records of the two sets of experiments. The steam generated and the superheating was the same throughout both.

K.

Time.	Water in c.c. per minute.	Temperature at outlet.	Temperature at inlet.
7 30	185	211	51
7.31	205	211	51
7.32	205	211	51
7.33	245	211	51
7.34	265	212	51
7.35	285	212	51
7.36	300	212	51
7.37	320	212	51
7.38	340	212	51

175 Aver. difference of temperature 160

19·4

Average number of thermal units of heat absorbed by the water at boiling point, 3113·7. The temperature of the water as it left the tube to flow into the c.c. measure was 178 deg.

The water from the tank was increased in velocity until steam bubbles stopped rising. The temperature fell to 202 deg. The water at the inflow rose to 53 deg. The following was the record of this experiment :—

L.

Time.	Water in c.c. per minute.	Temperature at outlet.	Temperature at inlet.
7.42	440	202	53
7 43	465	202	53
7.44	490	202	53
7.45	320	202	53
7.46	545	202	53
7.47	570	202	53
7.48	600	202	53
7.49	625	201	53

Aver. c.c. per minute, 26·43; aver. difference of temperature, 149.

Average number of thermal units absorbed per minute was 3933·6. The temperature of the water as it left the tube to flow into the c.c. measure was 180 deg.

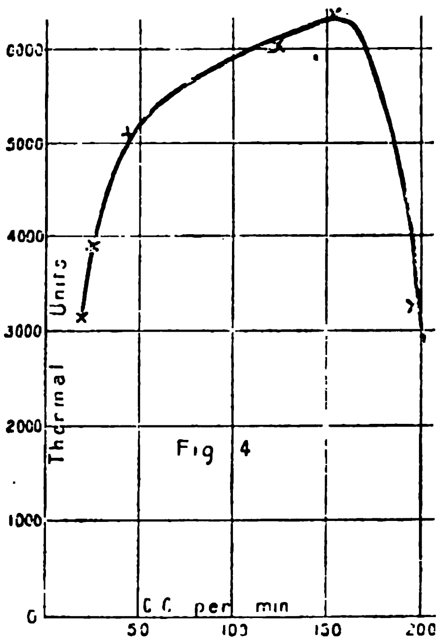
The increase in the number of thermal units absorbed by the water at 10 deg. below boiling point was thus 819·9. The statement made by the French experimenter was that at the boiling point the water takes in three times as much heat as at other temperatures.

The velocity of the water was again changed in order to note the effect of the change of velocity on the heat-absorptive power. The result is given in the table below:—

M.

C c. per minute.	Difference of temperature.	Thermal units absorbed per minute.
19 4	160 5	3113·7
26·43	149	3933 6
46	111·3	5119·8
125	48	6000
158·6	40	6314
193 3	17	3286·1

The accompanying curve—Fig. 4 - shows the manner in which the absorptive power increases with the velocity, and then falls off again after a critical velocity. The falling off is due to insufficient heat being supplied to meet the requirements of the more rapidly moving water. The same conditions would be found were there hot gases instead of steam, for the heat of the gases after a certain speed of the water would get forward with insufficient quickness to supply the water with ever-increasing thermal units.



MESSRS. TOLCH & CO., OF FULHAM.

THIS firm has a site most convenient for the launches and other small craft being taken down to the river, and if the numbers which have already been built for England are a sign, the firm has very fair success. A small launch, 20 ft. in length, had been only a few hours in the water before we went down to the place. It had been fitted with the patent reversible propeller Fig. A and with a single inverted cylinder launch oil engine, constructed on the Capitaine system. The oil was stored in the bow of the boat in a cylindrical tank, carrying a day's fuel, 2½ gallons. There was also a simple starting gear, which consisted of a small belt and a handle with a shaft, on which was fixed a small pulley. The shaft was inserted in a cylindrical hole on the end of the engine, and the belt enveloped the small pulley and a fly wheel fitted on the shaft of the engine. The shaft of the small pulley was fitted on an eccentric gear, worked with a small lever with a pin. When the belt has to be tightened, the lever is pulled back, it raises the small pulley by the eccentric motion, and when tight enough, the pin attached to the lever is let into one of the holes which hold the pulley in place. The handle is then turned and the engine started.

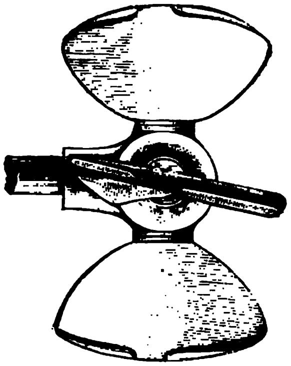


Fig. A.

Before we went down to the launch we were shown the engine Fig. 1A in the shops for driving the small dynamo. This dynamo serves twenty 16-candle-power incandescent lamps, and a hundred volts are obtained when the speed of the dynamo is 1,350 revolutions. The engine had to run about 400 revolutions and before it started we had the advantage of seeing the operation of heating up the vaporiser. This vaporiser is in the end of the engine: it consists of a vessel of cast iron, with a series of ribs all round it to promote the heat being taken up by the vessel. This vaporiser is charged with a small spirit oil lamp to it. The valve admitting the oil is forced open by the pump, which admits always a fixed quantity of oil. The air is drawn in by a valve at the top by the suction action of the piston. The exhaust valve and petroleum pump are worked from the crank and are under the control of the governor. When the speed gets too high, the governor cuts off the oil supply and the exhaust valve. The valves are thus motionless until the speed comes down. We cut out the propeller from the shaft several times, and in no case did the engine race. And when the propeller was placed at different notches, the speed of the engine kept quite constant throughout.

But coming back to the shop engine, which was of the type shown in Fig. 1A, and of three-brake H.P. A small spirit lamp was inserted under the vaporiser and allowed to heat that up. It heated it up for about five minutes, and when that had been done a small hand pump was worked at the side of the engine, which put about 6 lbs. pressure on the oil, and the tap was then opened and the oil permitted to enter the vaporiser by the valve. There is another little pipe which serves as a lamp on the outside of the vaporiser for heating that. The spirit lamp was now taken out and the stationary lamp lit to heat the vaporiser. The fly wheel was given a few turns and the engine started. The belt was also put on to drive the dynamo and all the lights switched on. A counter was used and showed a record of 440 revolutions for the engine, and 1,400 revolutions for the dynamo.

The volt meter showed 100 volts and the ammeter 8 amperes. There were 20 Ediswan lamps. Each charge of oil was $\frac{3}{100}$ of a cubic inch, and an explosion was made every second revolution. In this shop engine it will be seen that the pistons move out in opposite directions simultaneously, and the cranks being at right angles to each other, the reciprocating parts are balanced.

The launch engines are vertical, but they are worked in precisely the same fashion as the one already described. They are made single-cylinder engines, from one to 15 brake H.P., and double-cylinder, from six to 60 H.P. That fitted in the small 20 ft. launch was two brake H.P., making 420 revolutions per minute. The propeller shaft as it came from the engine, was $1\frac{1}{8}$ in. diameter, and after it went past the thrust block $1\frac{3}{4}$ in. diameter. The reversing of the motion of the boat, to cause it to go astern, is produced by the reversing of the blades of the propeller. The arrangement goes further than this, for the blades may be set at intermediate positions and held there by means of the lever going into a notch. The propeller has a hollow boss *a*, which is screwed into the shaft *b*, and there is a cap *c* fitted in the other end, Fig. 3. The blades, d d^1 have shanks and they can rotate through a certain angle in a bush *f*, screwed into a boss *g*. A pin *h* on the end of d^1 fits into a hole in the end of *d*. A collar *i* is screwed on to the blade and the bush *f* prevents the blades from coming out of their place. The cranks are shown at *j j*, and these fit into slots n *k*, and by this means the blades are moved. The plate *k* is thus like a crosshead moving in the guides *m m* and caused to move backwards and forwards by the rod *n* connected to the reversing lever.

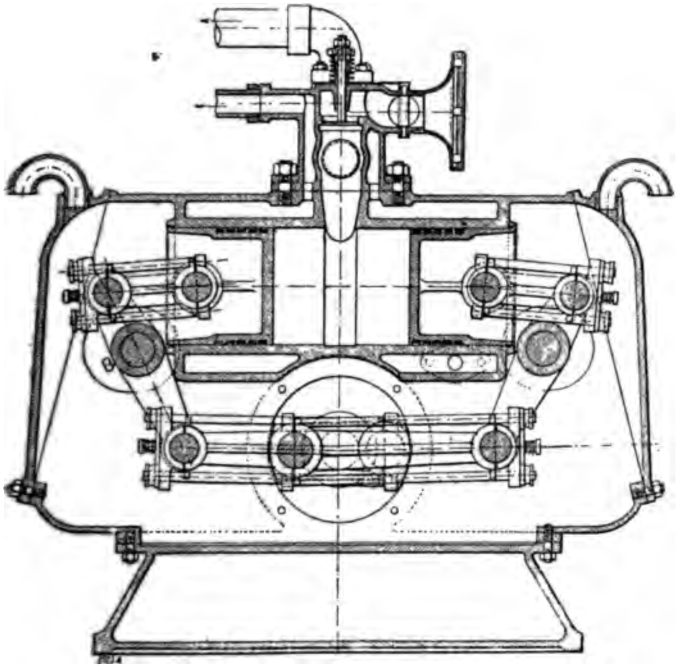


Fig. 1A.

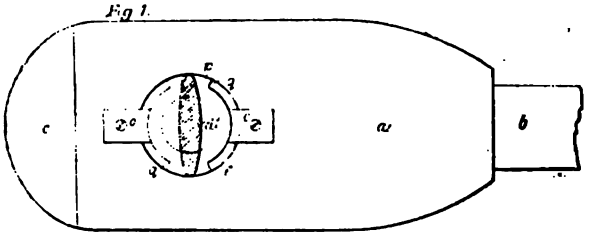


Fig 1.

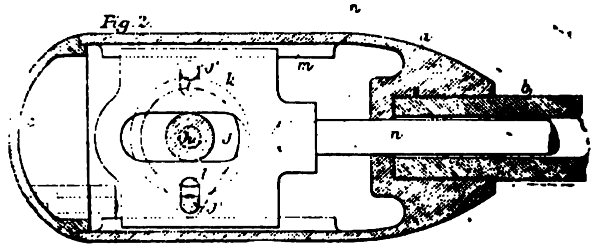


Fig. 2.

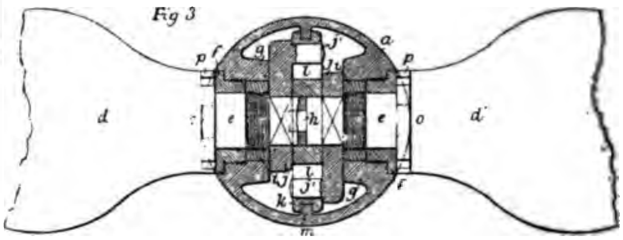


Fig 3

We moved the lever backwards and forwards after the engine had been heated up, and it kept making the same number of revolutions in whatever position the lever was placed. The current of the river was strong, and against the tide this small two H.P. oil-engine took $10\frac{3}{4}$ minutes to run a mile, and with the tide $7\frac{1}{4}$ minutes. At places where there was plenty of water it turned, with the helm full on, in little more than its own length. The engine is covered in with a wood casing, which became slightly heated just above the vaporiser; but there was not the least smell from the engine, and everything about the boat was spotlessly clean and it was evident could be kept so. The over-all dimensions of this engine were 31 in. in length, 23 in. in width, and 40 in. high. Cast iron ballast blocks had not been fitted in the bottom of the boat, and when one moved from side to side the boat went with them. There was accommodation for about twelve persons in the launch, and save for the little thumping of the exhaust at the stern there was no inconvenience felt in the least. The circulating cooling water is drawn in from below and discharged above water level at the side. The temperature of the water, as indicated by the hand, was little above that of the inlet water.

The illustration shows an oil motor launch fitted with a steering wheel close by the reversing lever, and it shows the compact nature of the machinery. In the

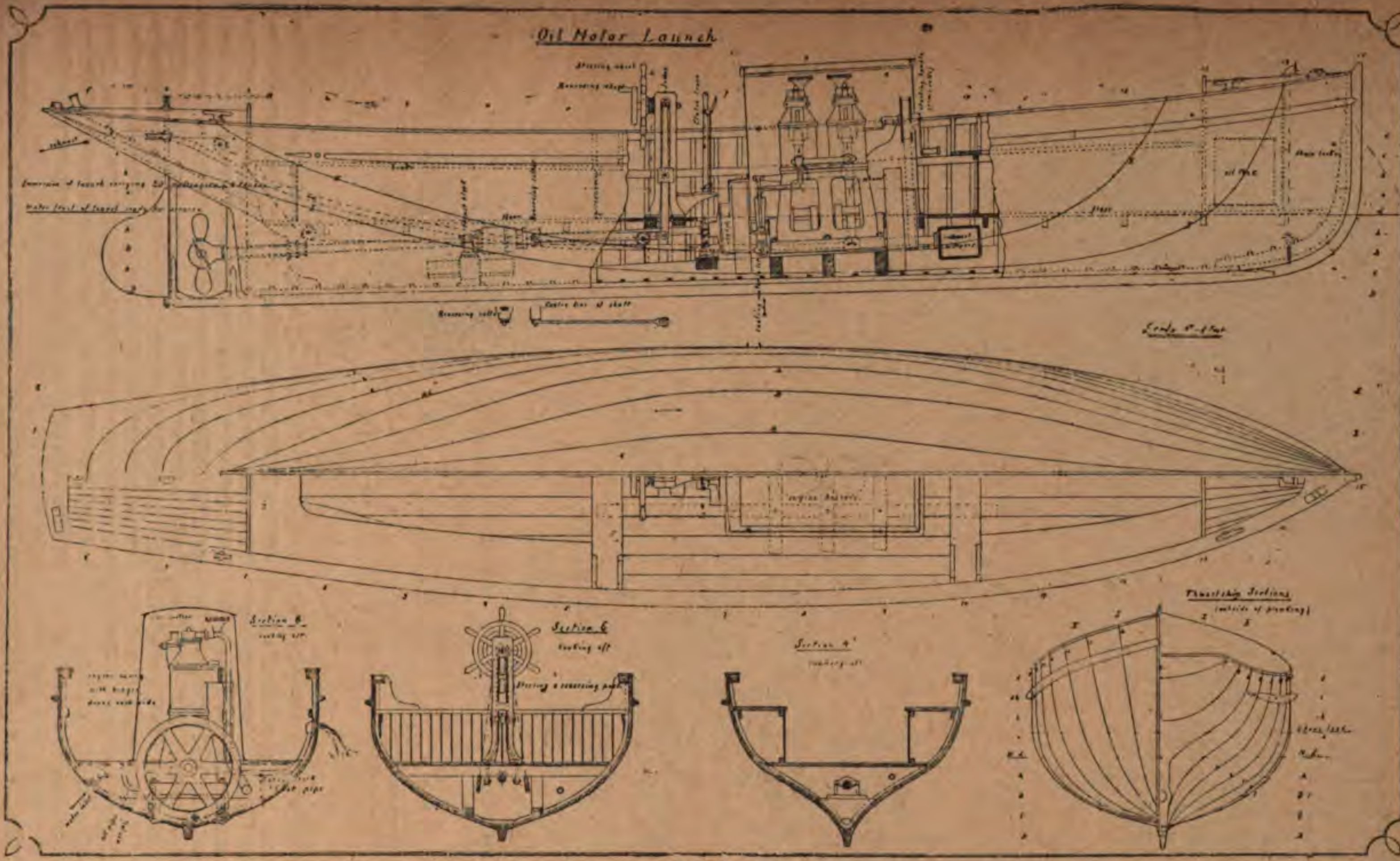

Oil Motor Launch
Steering wheel
exhaust
oil tank
chain locker
Centre line of shaft
Section 8
looking aft
Section 6
looking aft
Steering & reversing gear
Section 4
looking aft
Transverse Sections
(outside of planking)

FIG. 4.

bow is shown the oil tank and in front of that the chain locker. The figures 4 sufficiently explain themselves.

Messrs. Tolch have fitted a 15 H.P. engine in a cargo boat (250 tons) trading in the Highlands of Scotland, and so satisfactory has been its working that a repeat order for an oil engine of 20 H.P. has been given for a twin-screw cargo steamer. It will be seen from the drawing, Fig. 5, that the shaft of the engine has been placed athwartships and connected to the shafts of the twin-screw by means of bevel wheels. The distance between the centres of shafts is 7 ft. 6 in. The reversing motion of this engine is produced by two bevel wheels and the reversing lever moves the forward or aft bevel wheel into gear according as the motion is required forward or aft. The reversing levers are on deck as shown in Fig. 6, and by a system of link work they are connected to the clutch for the two bevel wheels. The plan of the engines are shown in fig. 7.

The cost of working these engines is given by the makers as ¾ pint of oil per brake H.P. per hour and the cost of this oil from a depôt a few yards further up the river is 4½d. per gallon. Twenty H.P. would thus use 15 pints per hour, and 45 gallons per day. That is 17s. per day for oil. A captain and two hands only are required in this 300-ton schooner. And the space required for the oil per day would be 7½ cubic feet. A similar steam engine would require to indicate about 25 I.H.P., and use 6 lbs. of coal per I.H.P. per hour, which would come out at 32 cwt. of coal per day. The cost of this would be at least 24s. and the space taken up by the coal for a day's run would be 70 cubic feet. Besides, an engineer with at least 8s. per day in wages would be required.

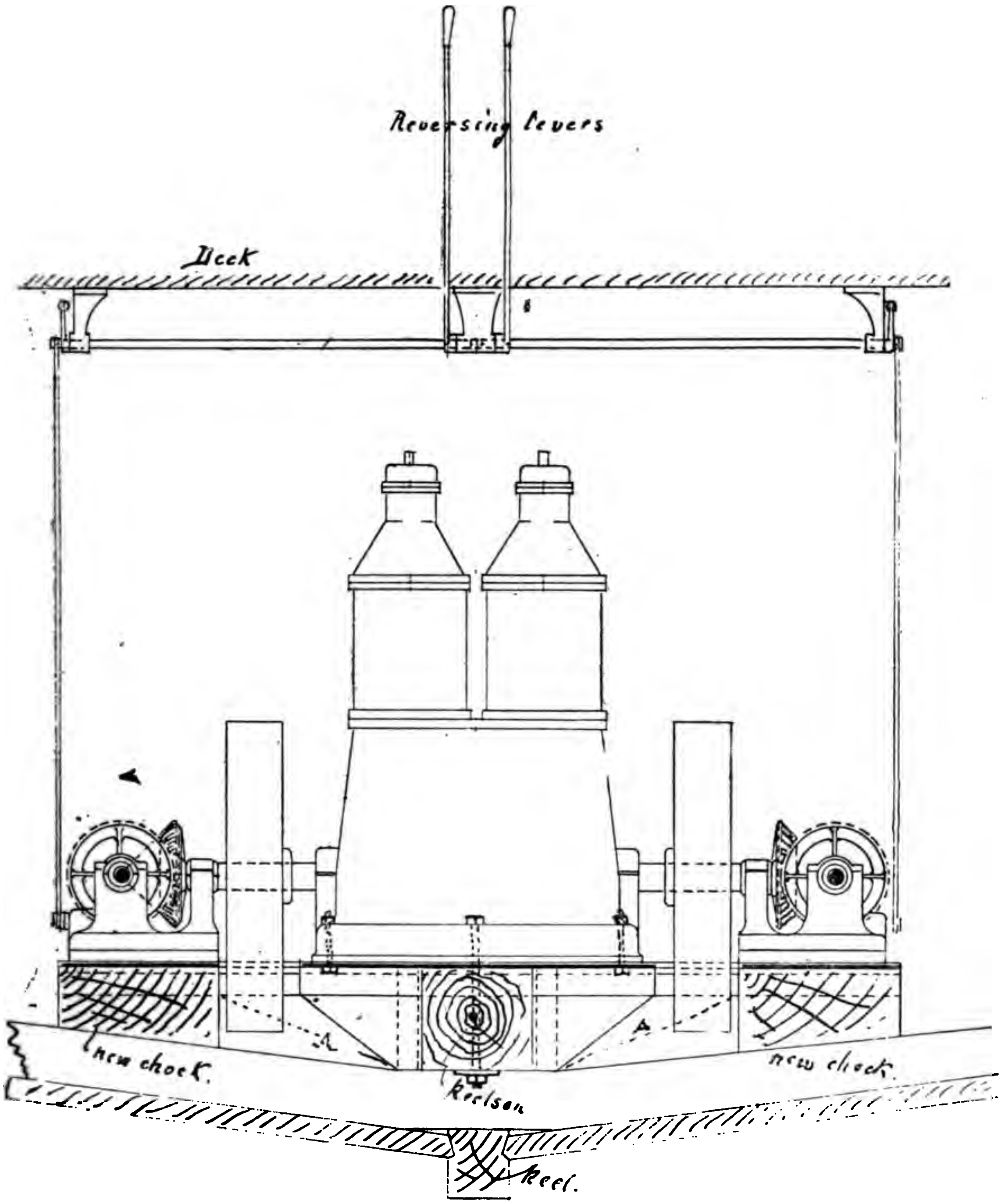


Fig. 5.

For small craft and small H.P. the oil engine has a future before it.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

An Event of no Little Importance

to all certificated officers of the mercantile marine is the well-deserved promotion of Mr. Walter J. Howell to the position of Assistant Secretary of the Board of Trade in the marine department. Mr. Howell has long been principal clerk with Mr. Ingram B. Walker in the assistant secretaryship. The retirement of the latter-named gentleman, through regrettable ill-health, has enabled an appointment which will be universally acceptable to everyone who knows anything about the working of the department to be made. Mr. Howell, who has spent a quarter of a century in the Civil Service, is as remarkable for his courtesy as for his profound knowledge of all things concerning the mercantile marine. If the engineering branch of the service know less of him and of his work than do the navigating branch, it is because they are more seldom in difficulties and less often asking for reforms, and are, in a word, more contented with their position and their prospects than their compeers.

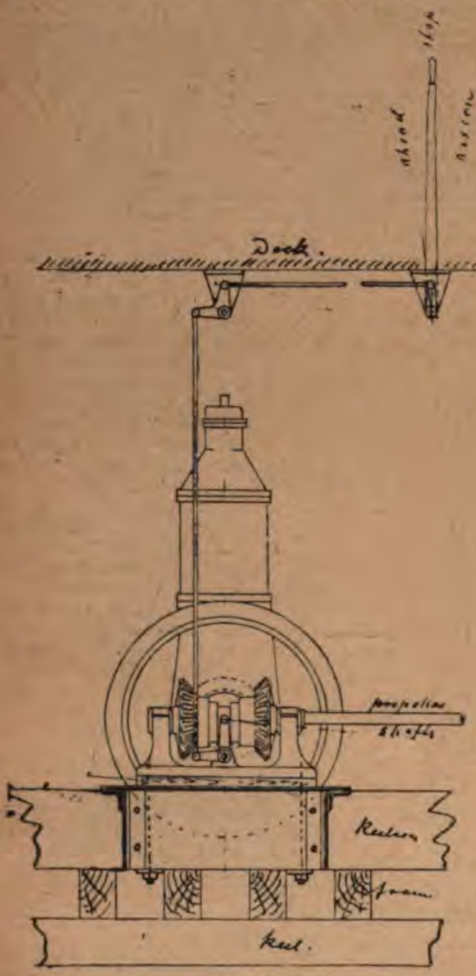


Fig. 6.

The City of Dublin Steam Packet Company,

who, with the building of the s.s. *Louth* in 1894, signified their belief that the time of the paddle, at least for their Liverpool and Dublin service, had gone by, launched the sixth of their screw boats for this trade in April, 1899. This was the *Cork*, built, as all the series have been, at Port-Glasgow, by Messrs. Blackwood & Gordon. Her approaching addition to the working fleet has enabled the company to dispose of the old paddler *Leitrim*, constructed a quarter of a century ago at Birkenhead by Messrs. Laird Brothers. The *Mayo* is now the only vessel of the old type left in their fleet, for the *Ireland* is also reported sold. This vessel was a famous ship in her day. She too came from Messrs. Laird's yard. But she is comparatively juvenile, having been launched in 1885. Her construction was agreed upon at the last acceptance by the Government of the old paddlers for the Holyhead and Kingstown mail service. It was stipulated that if the veterans were taken on again by the Post Office, a fine modern vessel should be constructed to aid them in their important work. She had the same length as the original boats, but 3 ft. more beam, and 6 in. more depth. Like them she had oscillating paddle engines, but her power was much greater. The cylinders of the old *Munster*—to take her as a type of the four original sisters—were 98 in. in diameter, and 84 in. stroke. The *Ireland's* cylinders were 6 in. greater in diameter, and 18 in. longer in stroke, but her machinery was on the single plan, and her boiler pressure was only 30 lbs., though she had forced draught. Though she came out so comparatively short a time ago, she was nevertheless considered a wonder in her day. An engineering paper of contemporary date, speaks of her in September, 1885, "as the fastest steamer afloat," on the results of her first trip across the Irish Sea. There were no torpedo-destroyers at that date, and doubtless the statement was an accurate one at the time it was made. At all events the vessel broke the record on her first appearance, making the crossing in 2 hours 58 minutes to the westward, and again beating the best previous known performance to the eastward, when she came back in 3 hours and 7 minutes to Holyhead. Her speed on the return voyage was 20.25 knots. The engines were in charge of Mr. Beavis, the engineers' manager. They indicated as much as 6,337 H.P., on the eastward trip, with 27.17 revolutions, yet there was only 27 lbs. steam. The number of revolutions seems high, at all events for that date, with the fact that her paddles are 33 ft. 4 in. in diameter, with eleven floats 13 ft. wide, and 5 ft. 9 in deep on each wheel. With the departure of the *Ireland* from their fleet, the old-established City of Dublin Company may be said to have left the paddle tradition behind it. The transition here has been rapid indeed. Five years ago the paddle ruled this company in both its mail and cargo service. Now they have but one paddle-ship in either service, and that is the *Mayo*, which in the ordinary course will soon follow her sisters of an earlier date into oblivion. It will be curious to see if the general concensus of opinion amongst practical managers of channel steamers, strongly accentuated by the choice of twin-screws for the new Royal yacht, will affect the use by the Kent Railway Companies of the old-fashioned method of propulsion. At all events those companies are only now kept in countenance in their conservatism by the highly subsidised steamers of the Belgian and Dutch lines.

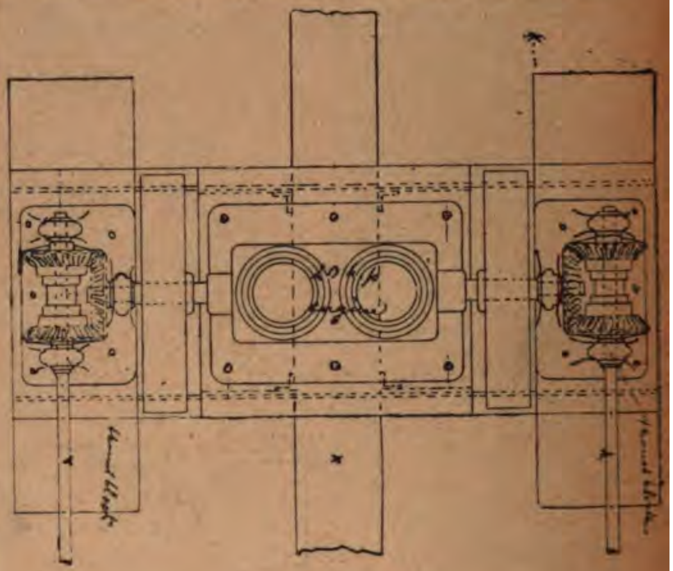


Fig. 7.

The Shaw Savill and Albion Company

have, as I mentioned last month, chartered one of their two finest vessels, the Denny-built *Tainui*, to the Allan Line. This vessel has not appeared for a long time now in the New Zealand trade, her last engagement having been to the Compania Trans-atlantica, where, under a portentous Spanish name, she was engaged in the transfer of Spanish troops to Cuba, when the Dons were trying vainly to cope with the insurrectionary forces. It would seem that the class of vessel which she represents is no longer altogether suited for the changed conditions of the New Zealand trade. She had a little too much speed, and was altogether rather too expensive in the cost of her working. New vessels of the *Aotea* type are taking the places of the older and more purely passenger ships. The *Kumara*, a fine big steamer with very large insulation for frozen mutton, has just been turned out for the line from the Dumbarton Yard, and the owners now announce that the *Arawa*, the speedier sister of the *Tainui*, is for sale. This vessel, like the *Tainui*, had a spell of work for the Spaniards. But she had another experience as well. It may be within the memory of some of my readers that when the Canadian Australian Royal Mail Steamship Company was deprived of the services of its steamship *Miowera* by an accident, which necessitated her coming to England for repairs, they chartered the *Arawa* for the interval, that vessel being at the moment within easy reach of Sydney, which was one of the termini of the Canadian Australian Line.

The Sydney-Vancouver Services.

Four days after the advertisement regarding the *Arawa* appeared, there was, curiously enough, a preliminary announcement to the effect that the line for which she rendered this service is coming into the market with its ships, its goodwill, and all its other property. It is to be offered in one lot as a going concern. This is rather a sad announcement, for it shows that another of Mr. James Huddart's undertakings has ended in more benefit to the public than to himself. One felt great sympathy with Mr. Huddart when the contract for the Fast Service to Canada, which he had so persistently and earnestly advocated, was given to Messrs. Petersen Tate & Company. That action on the part of the Canadian authorities does not seem to have benefited Messrs. Petersen Tate. It certainly did not aid the inception of the Fast Service. One felt, however, that the line to which Mr. Huddart then turned his attention might perhaps recompense him for his disappointment. The field between the flourishing port of Victoria, British Columbia, and the Australasian ports looked a promising one. He made a very good start with the two ships which he had built for it on the East Coast. These were the *Warrimoo* and the *Miowera*, which I described at the time they came out. The trade developed, and a third ship was needed. In an unfortunate hour the *Aorangi*, formerly of the New Zealand Shipping Company's fleet, was selected for the vacancy. A large amount of money was spent upon her to fit her for the new service. Her machinery and boilers were renewed, her passenger accommodation was reorganised, and she was sent out as a practically new ship. But the new interests introduced into the concern, and the heavy expenses incurred, were too much for the company. There was heavy litigation, and the line went into liquidation. Now we see from the announcement that the liquidator cannot see his way to continuing to work the line, and that thus he finds it necessary to dispose of it.

Messrs. Elder, Dempster and Company

have registered themselves as a limited company during the past month. The public has not had any opportunity of acquiring an interest in the business itself, which indeed is believed to be quite good enough for those who have built it up to wish to keep altogether for themselves. But outsiders have been allowed to apply for about six hundred thousand pounds worth of mortgage debentures, which are, of course, a first charge on the business. They thus obtain the best of security with the very tempting interest of 4½ per cent. It is interesting to observe of what the Elder Dempster Fleet—as distinguished from the several fleets, such as that of the African Steamship Company, the British and African Steam Navigation Company, and the Ocean Transport Company, which the firm manages—consists. The firm itself owns some seventeen steamers. Of these the greatest is the *Milwaukee*, of 7,317 tons gross register. The two smallest are the *Banana* and the *Yoruba*, of a little under three thousand tons each. The *Yoruba*, besides being one of the two least in size, is much the greatest in age. She has in fact attained the patriarchal age of four years!

Excluding her, none of the fleet are more than two years old. Messrs. C. S. Swan & Hunter are responsible for the building of five of these ships, whilst Messrs. Palmer's, of Jarrow, have constructed four of them. Messrs. A. McMillan, of Dumbarton, have turned out two. The *Degama* was built at Hartlepool, the *Yola* and *Banana* at Sunderland, and the remaining four vessels come from Clyde yards. The total tonnage exceeds 78,000 gross register. The vessels seem all to be in profitable employment, chiefly in the Transatlantic trade to United States and St. Lawrence ports. The return, as far as it can be arrived at, amounts to about seventeen per cent. on the valuation as estimated by independent authorities.

The "Fulda."

The extraordinary accident to the *Fulda* in a Birkenhead graving dock was the subject of a suit tried before Mr. Justice Bigham at the recent Liverpool assizes. A large amount of very expert evidence was adduced, and the trial occupied four days. Little fresh information as to the circumstances attending the disaster came out. We know that as the water left the ship ominous noises were heard; but such are not unusual under such circumstances. Then there was a report like artillery, as one witness described it. The stem of the vessel came down, then the middle ship, and lastly the stern, and in an instant the value of the *Fulda* was reduced from £37,000 to little over £11,000. The shock not only ruined the ship, but it split the very blocks on to which she had been let down. It appeared from the evidence that the ship had an unusual overhang forward. This extended as far back as 108 ft. from the stem, and probably no accident could have happened at all had she been so blocked that support was given to this part of her fabric. But no notice of her peculiar formation had been given by her owners either to the proprietors of the dock or to the firm which undertook the work of placing her in position. It was alleged that the blocks provided for her support were unfit for their work. But it was proved that the dock had been in use for forty years; that it had frequently been occupied by vessels of about her size within recent times, and that no accident had ever before occurred. In the result it was held that there was no blame to be attached to either set of defendants. The blocks were not in default, and there was no responsibility for what occurred capable of being attached to those who docked her. The peculiar construction and design of the vessel seemed accountable for all that took place. Notice of the peculiarity had not been given to either of the parties sued, and so they could hardly be held accountable for not taking special precautions in her case. A suggestion that her owners might be held liable for damage sustained by the dock itself through her collapse was sternly discouraged by the judge, and so the matter is—as far as one can see—finally closed. Shortly after the termination of the case the old ship left the Mersey on her return to Bremerhaven. The Canadian Steamship Company at least is not likely to see her again.

The Great Eastern Railway Company,

whose services to Holland from Harwich are certainly the best between England and the Continent both as regards ships and convenience of arrangements, has again provided an improvement for the benefit of those who patronise its route. For those who are travelling to Germany a saving of no less than 25 miles has been effected by the opening of a new Dutch line, whereby the detour to Amsterdam is avoided and Berlin is brought into a straight line of rail with the landing place at the Hook of Holland. The full benefit of the improvement will not be reaped, however, till the German authorities can be induced to run fast and complete connections through their territories in connection with the really admirable services provided by the Great Eastern Railway, both by sea and land, and by the Dutch Government through its State railways.

Liverpool

has now taken from Southampton the distinction of having the greatest graving dock in the world. The new Canada Graving Dock was inaugurated on the 2nd May, 1899, when the White Star cargo steamer *Cevic* was, without any ceremony, and in the presence merely of a few officials of the Dock Board and of the company which owns her, quietly received and accommodated. This is the way that characterises Liverpool, and contrasts strongly enough with the excitement that attended the Royal functions over the Prince of Wales Dock at the Hampshire port. A brief comparison of the principal dimensions of the two docks may be of interest: —Canada: length over all, 925 ft.; width at entrance, 94 ft.; depth of water on sill at high water, ordinary spring tides, 32 ft. 6 in.; capacity, 3,286,648 cubic ft. Prince of Wales: length over all, 750 ft.; width at entrance, 91 ft. 1 in.; depth of water on sill at high water, ordinary spring tides, 32 ft. 6 in.; capacity, *2,320,000 cubic ft. On the occasion of the docking of the *Cevic* the task of emptying the dock was completed in 1 hour and 40 minutes. This was effected by the use of three centrifugal pumps of 51 in. diameter, whose normal throw is 922 tons a minute, rising to an emergency capacity of 1,000 tons. There is an installation of six Babcock & Wilcox water-tube boilers to supply steam for the engines which drive these pumps, and the I.H.P. of the machinery is 2,200. I must add that, as I calculated out the figure marked thus * from rather doubtful data, I do not vouch for its accuracy.

The Compagnie Generale Transatlantique

inaugurated its intermediate service to New York, with the sailing of the *Woolloomoolloo* on May 9th. At present this service will be maintained by sailings once every three weeks. In connection with this there is a report that some famous ships are to be acquired by the company. Twelve months ago, when the war between Spain and the United States broke out, it will be remembered that the Spanish Government purchased three Atlantic liners of the first-class from the Germans. These were the *Havel*, of the Nord-Deutscher Lloyd Company—a fine single-screw vessel built by the Vulcan Company at Stettin—and the *Normannia* and the *Columbia*, of the Hamburg-American Steam Packet Company. These latter vessels were British-built twin-screw steamers, which had earned for themselves a very fine reputation in the passenger trade. From that day to this these steamships seem to have disappeared. They never did anything during the war, and they have remained in retirement since its close. Now, though there is nothing said about the *Havel*, there is a report that the Compagnie Génerale Transatlantique is buying the other two vessels for its New York service. Owing to the conditions under which it carries the French mails, it cannot use them in its Saturday mail service. But it would be quite possible to use them as extra steamers on other days. And it is thought that they may come in useful next year when the Paris exhibition is being held, and all the world and his wife is crossing from America to see the show.

The American Mails.

During the last few weeks the New York correspondent of the *Times* has seen fit to renew his attack on the British lines carrying the mails to New York. As on previous occasions he takes instances of letters and newspapers sent through our mails, and compares their transit with what their experience might have been if they had been sent in foreign bottoms. He is quite right to take what steps he thinks proper—if they be fair—to bring about any postal reforms of which he approves. But the remarkable thing about these comparisons is the fact that in every instance now, and in previous years, the case against the British ships is lamentably overstated. Now, one cannot expect a gentleman whose mission is to deal with questions associated with New York society, and with the higher international and local politics of America, to be personally very much imbued with a knowledge of steamship performance. He has his own engrossing and absorbing pursuits, and I know by experience that to carefully watch the mail lines takes up a great deal of time and attention. But a man who holds so responsible a position as that of the representative in the New World of the principal London journal ought to have at his command the best possible sources of information, and one of the elementary qualifications for his position should be the power to judge of the value of the information submitted to him. From what has recently appeared in the New York telegrams of the *Times* it would appear that the sources from which these attacks arise are bitterly hostile to British interests, and are not too particular when they can, either by suppression of fact, or by overstatement, make up an apparent case against the British Post Office and British shipowners. The *Times* and its correspondent know their own business, and can judge whether or not their position and standing will be advanced by the policy to which I refer. But the British shipowners, whose struggle on a very small Government payment for actual work done in the carriage of mail matter is already a very tough one—seeing that their competitors have large Government subsidies—have surely some right to expect that the representative London daily should not be used as the vehicle for exaggerated complaints as to the way in which they perform public services.

The Leyland Line,

which was incorporated as a limited company with a capital of £600,000, to purchase an old-established Liverpool business in the Mediterranean and Transatlantic trades, has just issued about £200,000 worth of debentures. We are thus afforded an opportunity of seeing the progress it is making, and the intentions of those who manage its affairs. It would appear that it now has a fleet of 28 vessels afloat; that since it bought the business it has re-engined and boilered five of its ships, and simply re-boilered one, whilst it has at the same time accumulated a sum of £374,000 in cash and investments. The money it is now raising will give it, with its investments, about half-a-million sterling ready money, which it proposes to expend in large additions to the fleet. About forty thousand tons of new shipping, in five bottoms, is to be added. One of the new ships will be a sister to the *Winifredian*, of 10,500 tons gross register, just built for the company at Belfast. The other vessels will be of a somewhat handier size, ranging down to 5,600 tons in the smallest of the quintet.

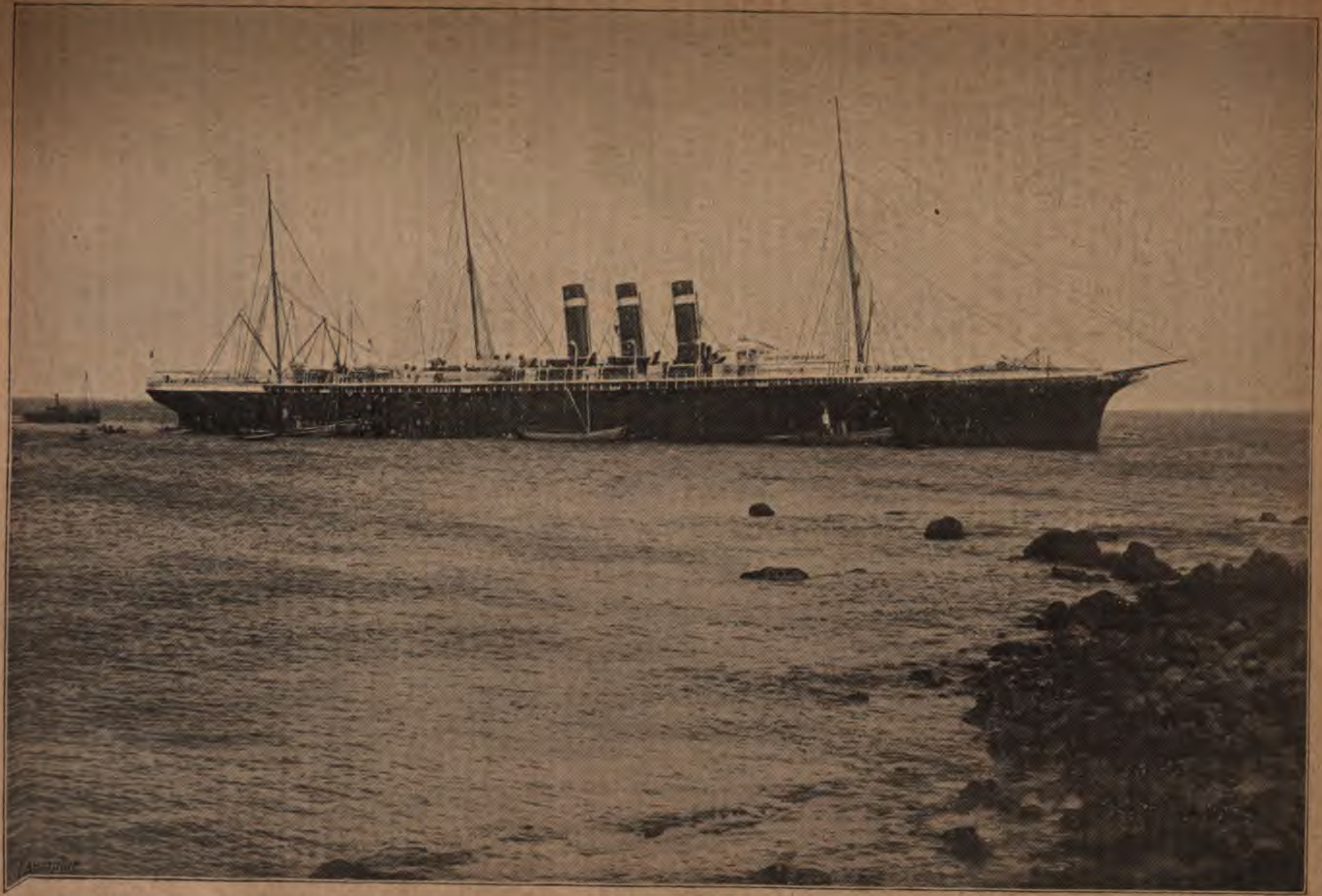
The Stella.

The inquiry into the loss of this vessel is now completed. As was altogether to be expected, there has been little result from these lengthy proceedings. The speed of the vessel is found to have been, under the circumstances, excessive. So much for the actual findings. As to the recommendations they do not amount to very much, either in extent or as to practicability. As about one-half of one per cent. of the lifebelts on board were found to be defective (though there were enough on board to give each person carried at least three sound ones), it is recommended that inspection of belts should be made at short intervals. No remarks on this point can be made save perhaps to inquire how frequently the Court would wish the inspection to take place. The desirability of carrying the boats swung out board in fog—when the state of the wind and sea allows—is also insisted on. Yet in the case under examination little gain could have been made by the adoption of this practice. In the evidence of Mr. Anderson, we have been given absolute data as to the splendid discipline of the crew as regards boat drill. By his watch the vessel struck at 4.11 p.m. That watch was stopped by water at 4.19 p.m. Thus from the time of striking till all was over it was eight minutes *at the most*. What time was taken up whilst the water penetrated Mr. Anderson's clothing and the case of a carefully made watch must be allowed from off that time. Surely better work could not have been expected under any circumstances. The Berthow boats do not come very well out of the test, for the time allowed was quite insufficient for their expansion. But it does not follow that these contrivances are useless altogether, because it is unusual for disasters to be so overwhelming and instantaneous. Then there is the recommendation that the booked time of arrival of the competing boats should not be identical or approximately so. It is thought by the Court that an alteration in this direction might avoid any suspicion of racing between the rival vessels. I do not agree with this. For if there be competition it will not be avoided by preventing the passengers from saying, "Such and such steamers always get in first." The answer to that will be that they start first also, and the rivalry, if rivalry there be, will merely shift to one of absolute speed. Then there is the suggestion of communication with the Casquets. With that there can be nothing but agreement. Moreover, it is possible that the invention of Signor Marconi's may not only aid us in effecting communication with the lighthouse from the land, but also may help the lighthouse-keepers to offer a warning note to vessels running into danger under the veil of fog. But time must be allowed for further experiments in this direction.

Strandings.

There are two unfortunate strandings to report this month. The first, in point of time, is that of the Allan liner *Gallia*, which, on her first trip up the St. Lawrence, has stranded on Sorel Island. It is hoped—though information regarding the whole matter is singularly meagre—that the matter is a trifling one.

The other accident is far more serious. It relates to one of the finest and largest vessels afloat, though the steamer in question is one whose name has unfortunately been previously in the disaster column. The American Liner *Paris* is not a lucky ship. She left her dock at Southampton at noon on Saturday, the 20th May, for Cherbourg and New York. Captain Watkins, who has had charge of her for so long—before ever he or she went on to the American register—was in command, and she passed Hurst Castle at 1.30 p.m. Running across to Cher-



(*Photographed by W. M. Harrison, Falmouth, on May 24th, 1899.*)

THE STRANDED "PARIS" OF THE AMERICAN LINE, SHOWING HER POSITION ON THE ROCKS AT LOWLAND POINT.

bourg to complete her complement of passengers and mails by embarking about fifty persons, she made her departure at 6 p.m., having then on board 140 bags of mails, 85 saloon passengers, 109 in the intermediate cabin, and 192 emigrants. Her crew comprised 372 persons, so that altogether there were 752 souls aboard her. As far as is known the weather was misty, but not actually foggy. But, at all events, some seven hours after leaving the French port the big ship ran on the Manacles, where on the 14th October last the Atlantic Transport Company's steamship *Mohegan* was wrecked with so great loss of life. As day broke the not very encouraging sight of the masts of that unfortuuate vessel were apparent, close to where they themselves lay, by those aboard the *Paris*. But their fortune had been far better than that of their predecessors. They had gone on to the Lowlands, which seems to be the only shelf of rock in the vicinity. There was no fear of the vessel sliding off and foundering in deep water, and eventually the mails, passengers, and baggage were conveyed to tugs and sent off to Falmouth, which is but eight miles distant from the scene of the mishap. The *Paris* lay with a list of but five degrees to port, and showed no sign above water of the precarious position in which she was. The crew remained on board. It was soon, however, apparent that she is very seriously damaged. Her fore part was full of water, and the fore stoke-hold was flooded. The diver's report as to the damage which he could ascertain was not very favourable, whilst he suggested that the double bottom had sustained very severe injuries. At the time of writing the prospects of floating seem very doubtful. We shall see. In the meantime, however, I am pleased to see that all the officers, from Captain Watkins downwards, maintain the utmost reserve. It is quite proper that they should. I cannot use words strong enough to express my opinion of the bad taste—to use no stronger expression—which prompts such letters as that of Admiral de Horsey, published in the *Times* of the 24th May. A casualty has occurred. Nothing that is written now can prevent that. Let us leave things as they are, and not rush into print to advocate our own little fads and to break down, as far as we can, the reputation of a distinguished seaman, and to minimise the precautions for safety taken by a great company which, since it opened its present line of communication, has never had a serious accident.

Some indication of the feeling amongst underwriters in regard to the prospects of refloating the *Paris* may be gathered from the fact that the rate of fifty guineas per cent. was paid for re-insurances in regard to her on the 23rd May.

A Famous Greyhound

will shortly be removed from the list of the fleets of the mail lines; for the *Alaska*, once the record-breaker of the Atlantic, has been sold for breaking-up purposes. It is long since she was seen on the New York route; but she, like other ships mentioned in this instalment of notes, served the Spaniards by taking troops to Cuba under an unfamiliar name. Since then she has spent a long time laid up in the Gareloch, where, as may be remembered, she on one occasion made as though she would founder at her anchors. She finally changed hands at the price of £17,500. In the next issue of notes I shall hope to give a more detailed memoir of her.

The P. & O. "China"

was dry-docked by her builders, Messrs. Harland & Wolff, on the 23rd of May. The delay had doubtless been owing to the great pressure of work—much of it of a very urgent kind—which they have long had on their hands. But the fact that the docking has taken place so recently shows fairly conclusively that all the rumours as to the owners' intentions regarding her have been quite unfounded and premature. They are not likely to make up their minds till the experts have carefully examined and reported upon her under-water damage.

The Castle Line

has been constructing so much first-class tonnage of recent years that it has been remarkable to see such ships as the *Tantallon Castle*, the *Dunvegan Castle*, the *Carisbrook Castle*, and the *Braemar Castle*, to say nothing of the more purely intermediate boats, coming out each with her single set of machinery. It was held by the successful firm of Fenchurch Street that for a long voyage with few calls the single screw was sufficiently handy for all practical purposes; whilst the great strength put into the engines, and the careful system of balancing adopted in the machinery, offered substantial guarantees against breakdowns. But when the constantly increasing size of their mail vessels passed the 9,000-ton limit, and when the H.P. rose to 10,000, it was felt that the time for subdivision had come, and the new vessels now completing for the Castle Line at Fairfield are both designed on the twin-screw principle. Thus of passenger lines claiming to any importance the P. & O. alone have the unenviable distinction of adhesion to the single screw.

COMPRESSED-AIR MACHINERY.

THE use of compressed air as a means for the transmission of power is becoming more generally used as time goes on, owing, no doubt, to the simplicity of installation, the convenience and universal presence of the medium, and, lastly, the non-existence of any difficulties with regard to the exhaust or to leaks in the apparatus such as exist in hydraulic systems.

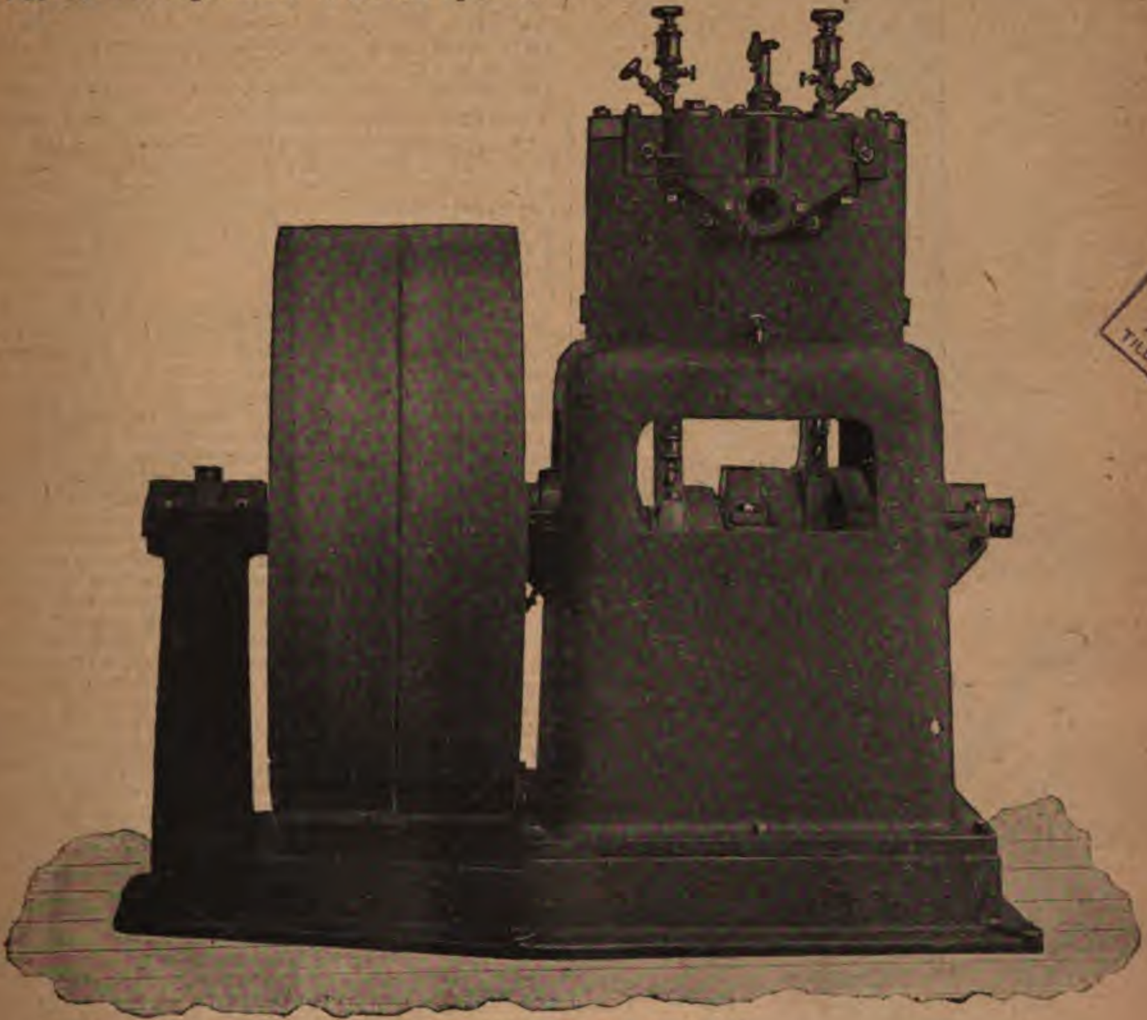
In the adjoining illustrations we show some of the compressed-air appliances which are sold by the United States Metallic Packing Co., Limited, of the Soho Works, Bradford, England. In Fig. 1 we show one of the single stage air-compressors for belt-driving. The cylinders, which are 8 in. in diameter and 8 in. length of stroke, are both single-acting, thus all stuffing boxes and crossheads are eliminated. The capacity at 120 revolutions per minute is 50 cub. ft. per minute, and at 100 lbs. terminal pressure per square inch these compressors absorb 9·2 H.P. Water-jackets completely surround the cylinders, cylinder heads, and valve cases. The cooling water enters through the valve case jacket, and passes thence through the heads and cylinder jacket; properly located partitions ensure a thorough circulation.

The valves are made of the poppet gravity type of phosphor bronze, and work without springs; they are located in a separate case. The discharge valves have renewable seats, and by removing a brass plug the valves can be reached without breaking any pipe connection or other joints. The valves are so constructed as not to break and fall into the cylinders. The pulleys are two in number, one loose and the other tight, the latter being formed heavy enough to act as a fly-wheel, so as to ensure smooth running and long life to the belt. The compressor is fitted with a governor, which is combined with the valve case, and is so arranged as to automatically maintain any desired air pressure. This is effected by stopping the compression of air without stopping the machine as soon as the pressure of air in the reservoir reaches a desired limit, and when the pressure has fallen one or two pounds it allows compression to commence again, so that work is only done when wanted, and no energy wasted as in compressors which have no governor, but only a safety valve on the reservoir. A further feature is that, by turning a small handle on the governor, the compressor can be started under no load; and, when the fly-wheel is in motion, the load can be thrown on, thus preventing undue strains on belts, shafts, &c.

In Fig. 2 we show an external view of the valve used on compressed-air installations for the control of the air to the recipient device. The valve is of the sliding type, and so tends to wear tight. There are no stuffing-boxes on it and it is self-closing by means of a spiral spring and bridle chains as soon as the hand chains are released. A safety check is provided on the valve, so that the load will not fall in the case of the air hose breaking. A speed adjustment is also fitted, so that a safe rate of hoisting or lowering may be ensured, irrespective of the amount of valve opening or load, so that a careless operator cannot cause accidents by raising or lowering loads too rapidly.

Fig. 3 shows an air jigger, or hoist, having a steel cylinder 15 in. in diameter and 5 ft. stroke. As in other jiggers, a wire-rope sheave is carried upon the outer end of the piston rod. The hoist here shown was made for attachment to the mast of a steel jib crane for use in a foundry. Of course, when convenient the lifting may be direct; that is, the cylinder may be hung by a hook to some overhead support, while the piston rod may carry a hook or other device to which the load can be readily attached. This latter forms a very simple arrangement, and is extremely convenient when short lifts only are required—viz., those within the range of the stroke of the cylinder. Such a self-contained device as this can be readily put up and taken down in a fitting shop to suit varying circumstances and jobs, all that is necessary being that some means be existent to attach or hang the hoist to. If rolled steel joists are available, a very simple carriage can be devised to roll on the flanges of the joists, to which the hoist cylinder can be depended.

There is, no doubt, a wide field of application for simple and convenient labour-saving machines, and it would appear that compressed-air devices should fill many wants in this connection.



Compressed-air Machinery. Fig. 1.

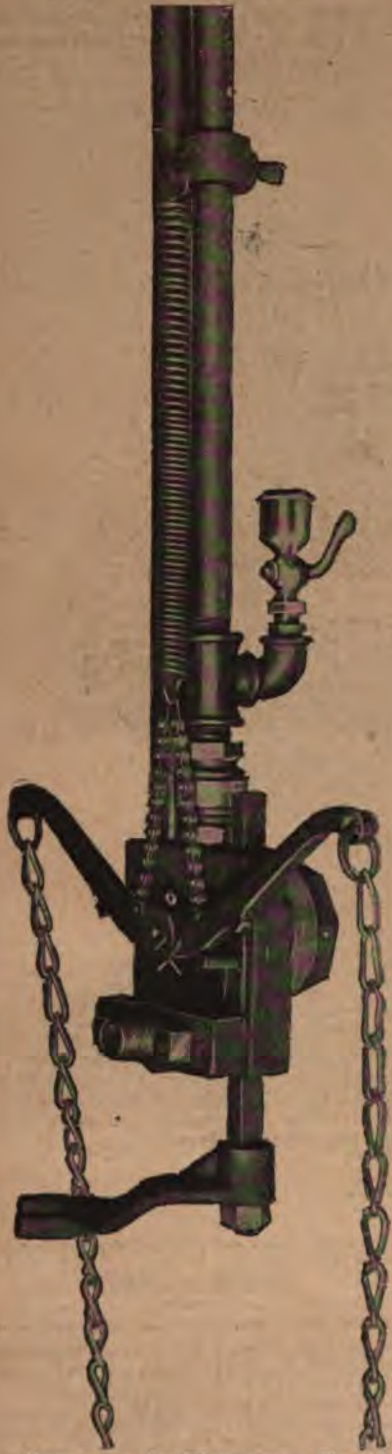
THE NEW PUBLIC LIBR ASTOR, LENOX AND TILDEN FOUNDATI

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

The Training of the Engine room Department.

MR. C. M. JOHNSON'S ideas about the training of engine-room complements are all right enough up to a certain point, but when reading his criticisms one must remember that as regards the stokers they cannot learn their work ashore, and the same may be said of the young engineer officers, whom the retired chief inspector of machinery asserts are sent afloat devoid of any practical knowledge of their duties. The same thing could be said of the seamen-class. Everybody who is employed upon a battleship learns the practical part of his work there. Stokers might certainly undergo a course of training on board a ship specially adapted for the purpose; but this scheme was considered some years ago, but found little favour with the Admiralty. For practical purposes the system employed at present answers fairly well. A certain number of young stokers go to sea to learn their trade under a number of old stokers, and although the argument that it is unwise, and even dangerous, to allow untrained men to be sent afloat holds good to a certain extent, it must always be remembered that *they are* under the care of other stokers much older and with more experience than themselves. Mr. Johnsen says, "If these newly-raised officers and men were borne as supplementary to the official complement of the engine-room for the purpose of being trained, we might be thankful for the half loaf; but even then we should know that the instruction would be at best perfunctory and devoid alike of thoroughness and system." But it seems that whether newly-raised officers and men are borne as supplementary or otherwise, they are in the engine-room to be taught. It would not be wise to join issue with Mr. Johnson when he says that for the first two years of a commission, no ship is possessed of a full-trained engine-room staff, but he has omitted to say, that in every new vessel it is some time before the officers and men of the engine-room, whether all trained men, or part learners, become used to the machinery. It is certain, however, that if we can put trained men into the engine-rooms of every newly-commissioned vessel, it would be a great advantage, and if Mr. Johnson's letter brings about this happy state of affairs, then he is to be congratulated.



COMPRESSED-AIR MACHINERY. FIG. 2.

The Internal Construction of Torpedo Boats.

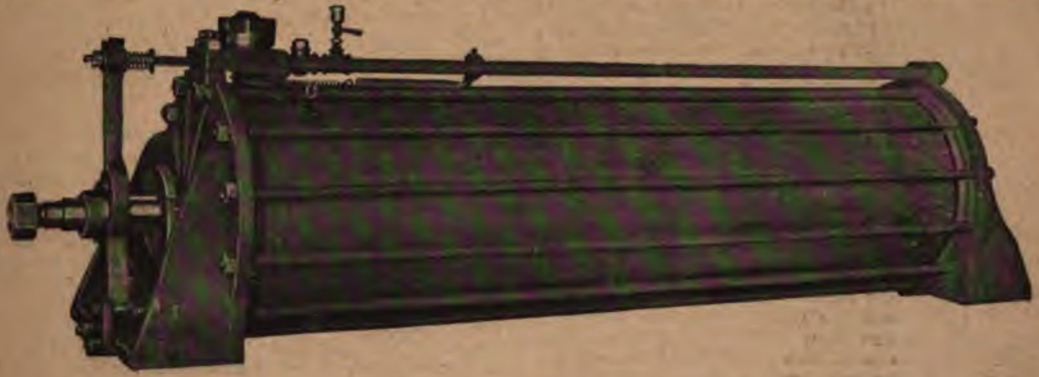
The attention which the United States Navy has received since the late war with Spain has resulted in schemes for the addition of warships of all dimensions, from torpedo-boat-destroyers upwards, to the Navy of that country. From news to hand from America it appears that considerable additions are to be made to the torpedo-boat flotilla, and therefore a paper submitted to the United States Naval Department by Lieut. Commander W. M. Kimball, in command of the North Atlantic torpedo-boat flotilla, on the subject of the machinery of torpedo-boats, has been read by the chiefs of the Naval Department with a good deal of attention. In the course of his paper Commander Kimball states, concerning American torpedo-boats, that the exact balance of the main engines cannot be too carefully attended to, and that connections should allow either engine to take steam from any boiler, both from main and auxiliary steam piping system. He considers that surface blows are desirable, for boiler water will get dirty in spite of all precautions. Coal bunkers abreast engine rooms, says Commander Kimball, give no real protection, because when trimmed for an attack they should be empty, to give the boat her speed. On account of the inaccessibility of the coal in them they would never be used except in long slow runs—so long and so slow that it would be much better to tow the boats than to steam them. There cannot be any properly constructed coal bunkers aboard torpedo boats, and the real solution of the difficulty is to resort to liquid fuel. The idea of engine protection by bunker coal is delusive; for not only should the engine-room bunkers be empty to put the boat in fighting trim, but even if some coal be in them it will provide no protection, for the things most needing protection are the steam pipes that must be placed high. Therefore, for torpedo boats Commander Kimball would run the engine rooms out to the side, and, if necessary for coal supply, fit thwartship bunkers. Commander Kimball may be right in the majority of his assertions, especially as regards the idea of engine protection by bunker coal. The use, however, of liquid fuel on board the *Surly* has not given the results which were anticipated, and therefore the difficulty he mentions as regards the coal bunkers is not likely to be solved yet awhile.

Devonport Dockyard.

Although the *Bulwark* has only been in hand since the 20th of March last, an effort is to be made to get her afloat by the end of the present year, and if this is done, this yard will have launched three battleships within 18 months, which will be a record. It is announced that the *Ocean* will be ready for sea on the 18th of August. It is 30 months since she was laid down. The announcement that Admiral Sir Henry Fairfax was to assume command at this yard on the retirement of Admiral Sir Edmund Fremantle was received with a good deal of satisfaction. Admiral Fremantle's jubilee of his connection with the navy will be reached on the 9th of this month, and he hauls down his flag, probably for the last time, amid the keen regret of everybody who knows him. Rear-Admiral Carr's connection with this yard, and the navy also, comes to an end this month; but he carries with him into retirement the respect and good feeling of all connected with Devonport. The refit of the *Melampus* has been completed, and the vessel despatched to Kingstown. The *Psyche* has also been made ready and sent on her first voyage to the North American Station. It is her maiden commission, and the fact that she was built, engined, and completed at this yard will cause a good deal of interest to be taken in her future career by all Westcountrymen. She is to replace the *Pallas*. The cruiser *Highflyer* has arrived here to be completed for sea. The cruiser *Blonde* has been commissioned after undergoing a refit, which cost nearly £9,000. The *Pique* has also been refitted at a cost of £10,000, and has completed her trials. The *Dwarf*, which has arrived here from Glasgow, is to prepare for commissioning as quickly as possible, and will probably be sent to the China station.

The Launch of the New "Victoria and Albert."

On the 9th of last month the third Royal yacht of the name of *Victoria and Albert* was launched from Pembroke Dockyard, H.R.H. the Duchess of York, performing the christening ceremony. Mr. Goschen, Sir William White, Admiral Sir E Fremantle, and Rear-Admiral Sir J. Fullerton, with others, were present at the launch, which was a most successful one, the new vessel taking the water in splendid style. A good deal of information about the vessel has been given from time to time in these columns, but in the circular given out to all newspapers who made application for it the Admiralty gave a good deal of additional news about the ship Compared with the present Royal yacht the new vessel has an additional deck, and the State deck is about ten and a-half feet above the water. Between it and the upper deck are situated Her Majesty's apartments and those of the Royal family, the cabins assigned to their suites, and those appropriated to the commanding officers and the principal naval officers attached to the vessel. The apartments of Her Majesty resemble in their general arrangement those in the old *Victoria and Albert*, but they are more spacious, and a private dining-room has been added. These rooms occupy the central portion of the State deck where the minimum of motion in a seaway should occur. The apartments of the members of the Royal Family are placed abaft those of Her Majesty, extending over a considerable length on the State deck. They are succeeded by the apartments of the Royal suite. Rather more than half the length of the vessel is occupied by these three series of apartments, and a wide corridor extends from end to end, with convenient staircases leading to the upper deck. Above the upper deck, towards the after part, is a large pavilion or saloon, besides reception and smoking rooms, and the top of the pavilion forms a promenade. It is hoped the new vessel will be ready for her steam trials towards the end of the present year, when she will leave Pembroke for Portsmouth. She is expected to be ready for service early in 1900.



COMPRESSED-AIR MACHINERY. FIG. 3.

Mr. Goschen and the Navy League.

The deputation from the Navy League, which waited upon Mr. Goschen the other week, did not meet with the reception which it is possible it expected, and as far as the First Lord of the Admiralty is concerned, state-aided training ships are not likely to be instituted yet awhile. The deputation may be said to be the outcome of the letters written by the novelist, Mr. Clark Russell to the *Morning Post*. The tone of these letters indicated that Mr. Russell thought that in case of war the Navy would get a bad licking unless it could get help from the merchant marine. This may have been partly true as regards the Navy of fifty years ago, but Mr. Goschen made it very clear indeed that the Navy of to-day was in no want of men, and not likely to be if war did break out. Mr. Clark Russell's knowledge of naval affairs was not deep enough for him to know that the personnel of the Royal Navy does not look to the Merchant marine for its war reserve. The scheme which the League proposed of state-aided training ships originated probably with Mr. Yoxall, M.P., and he was slightly incorrect when he asserted that the Reserve had not increased, and his statement that the Admiralty were embarrassed by the manning question drew from Mr. Goschen an emphatic denial. Mr. Goschen would not admit that the sources of the Naval Reserve were drying up, and said that the Board was well satisfied with the fishermen, a pleasing assurance to those who remember that in its infancy it was confidently asserted that the experiment would be a failure. The deputation finally withdrew, having accomplished nothing. It does not seem fair to the general public that merchant seamen should be taught their trade at the public expense, after having probably had a free school board education, and then turned over to the shipowners, who would reap practically all the benefit, although it is proposed that the Admiralty should be able to claim in time of war the service of these men. And yet, on the other hand, some scheme can surely be devised for ousting the foreigners from British ships.

Sheerness Dockyard.

The new cruiser *Pomone*, the last of the three cruisers of the "P" type to be completed at this yard, is now ready to take her place on the East Indies Station, under the command of Captain E. A. Simons, as the gunboat *Redbreast* is returning home. The *Galatea* has been completed, and has now departed for Iceland, there to protect the interests of the British fishermen. The *Partridge* has completed her refit, and has now left to relieve the *Magpie* on the Cape of Good Hope and West Coast of Africa Station. The appointment of Admiral Sir Charles Hotham, as Commander-in-Chief at the *Nore*, expires within the next two months, but the name of his successor has not been officially given out. The water-tube boilers for the new sloop *Rosario*, which are being made in the Keyham Steam Factory have not yet been delivered, but she is now quite ready for them. Her sister ship the *Condor* continues to make good progress, as do the *Sheerwater* and *Vestal*.

Temperance in the Navy.

Miss Agnes Weston certainly deserves her title of "the sailor's friend," and every seaman, whether of the engine-room complement or otherwise, must feel grateful to her for the services she has rendered the Navy during more than twenty-five years of her life. Miss Weston attended a meeting at Exeter Hall about a week back, and there said that there was a steady increase of temperance in the Navy. She pointed out, too, that she used the word temperance as meaning total abstinence. There are probably thousands of men in the Royal Navy who, although not quite total abstainers, are really temperate men. Miss Weston apparently thinks it quite sufficient if she can induce the men to be temperate without becoming total abstainers. In reviewing the work of the year Miss Weston mentioned the Royal summons to Windsor Castle which she received last year, and said that when shortly afterwards her Majesty sent her her own signed portrait from Osborne as a personal gift, she felt, as she wrote to the Queen, that not only would it be treasured as an heirloom, but that when tired and dispirited she should look at it and gain fresh strength by remembering the kindly interest shown by her Majesty. She also mentioned that a naval officer of high rank had come over from Germany to enquire into the methods of working adopted at the Rests with a view to commencing the building of similar institutions in Germany. A naval attaché of the United States had also visited the Portsmouth Rest for the same purpose. Miss Weston, it may be added, has received the £5,000 she asked for as a silver wedding present for Portsmouth, and she stated that she felt quite sure she would get the £10,000 she had asked for the enlargement of the Devonport Home.

Lord Charles Beresford and the Engineers' Grievances.

The speech made by the ubiquitous Lord Charles Beresford at the annual dinner of the Institution of Mechanical Engineers was extremely non-committal, and yet it showed that the noble lord was desirous of cultivating a good opinion of the naval engineers. He considered, and quite properly, that any complaints should be placed before the proper authority, and he further considered that a Departmental Committee should be formed to enquire into the matter. By going to the engineers themselves for information Lord Charles discovered what everybody else has been cognisant of for more than a year, that the engineers wanted "executive rank, the curl on the arm, and the power to inflict minor punishments." In his opinion the number of engineers was too small. A ship should be as near as possible self-supporting. If there were not enough expert engineers in the ship, the repairs could not be carried out. All complaints which reached the authorities should be threshed out, and they should show that it was either a just complaint or an unjust complaint, whilst a Departmental Committee should be appointed at once. The pros and cons of this question have been considered over and over again, and it would be useless to reopen the question at the present moment; but, if Lord Charles Beresford has any influence at Whitehall or in Parliament, he will earn the everlasting gratitude of the naval engineers if he will use it to get a few of their grievances redressed.

Pembroke Dockyard

The chief event of the month at this yard was, of course, the launch of the new Royal yacht. It is proposed to spend upon this vessel, during the current year, £104,245, more than £33,000 of which is for labour, and nearly £23,000 for machinery. It is noteworthy that there are still a few individuals employed at this yard who were working here in January, 1855, when the old *Victoria and Albert* took the water. The new first-class cruiser *Drake*, which has now been in hand five weeks, makes fair progress, and the number of tons of material worked into her up to date gives a very good average considering that the number of hands employed upon her is not quite as many as could be wished for.

The United States Navy.

One result of the war waged with Spain by the United States is that a great demand has arisen for the presence of United States' warships in different parts of the world—a demand which the Navy Department has not found it easy to meet, despite the fact that every available vessel is being commissioned, and new ships completed as fast as possible. There are now fleets in the Philippines, West Indies, and the North Atlantic, and there is to be a squadron in the South Atlantic, of which the *Wilmington* is already on the station, and the *Chicago* on her way out. Of the ships now on the stocks, the *Kearsarge* and *Kentucky* will be ready for service in a month or so; and as regards the other ships, their state of advancement works out as follows:—*Illinois*, 64 per cent.; *Alabama*, 80 per cent.; *Wisconsin*, 65 per cent.; and the cruiser *Albany*, 80 per cent. The battleships *Maine*, *Missouri*, and *Ohio*, and the monitors *Arkansas*, *Connecticut*, *Florida*, and *Wyoming* are not yet in hand. The torpedo-boat destroyers are none of them far advanced, but several of the torpedo-boats will very soon be ready for commissioning. Tenders for armour for the *Maine*, *Ohio*, and *Missouri*, and the four monitors mentioned have been asked for, but the price must not exceed £80 a ton—the sum fixed by Congress. With the armour required for the battleships *Pennsylvania*, *New Jersey*, and *Georgia*, and the armoured cruisers *West Virginia*, *Nebraska*, and *California*, about 24,000 tons in all will be wanted; but there is a little doubt as to whether the leading armour-makers will submit to bids at this price. If they will not, the matter will have to be reconsidered by Congress.

The Scylla's Gunnery Practice.

Captain Percy Scott, commanding the cruiser *Scylla* in the Mediterranean, has earned the thanks of My Lords of th Admiralty. If any member of the House of Commons now dares to hint that we are behind other Powers as regards gunnery, Mr. Goschen has only to mention that the *Scylla*, when recently employed in the Mediterranean, achieved the highest record at prize firing ever attempted. The remarkable shooting in question took place on the occasion of the annual prize firing of the *Scylla* in the Mediterranean. Steaming at twelve knots, seventy rounds were fired at a target 1,600 yards distant, and fifty-six direct hits were recorded, or eighty per cent. of successes. At a dinner given by the petty officers of the ship to commemorate the approaching termination of the *Scylla's* commission, the vice-chairman said that this record of straight shooting had never been approached before, and was not likely ever to be beaten. Replying to this, Captain Percy Scott said: "As regards your success in straight shooting with heavy guns in the prize-firing on Wednesday, I believe the statement that the score of 80 per cent. is a record to be absolutely correct, and it gave all the officers and myself very great pleasure to see it, although I fully expected you to reach 90 per cent. I only hope, however, that if you are ever called upon to fire at an enemy, you will knock him about as much as you did that target. Straight shooting with heavy guns is the most important part of a sailor's education, and you cannot pay too much attention to it. An action of the future will be decided—and quickly decided—by the straightest shooting, and it is upon the men behind the guns that the nation will have to rely." Of course, one swallow does not make a summer, and the remarkable prize-firing made by one British cruiser does not prove that the gunnery of the British Navy is superior to that of every other navy. However, there is no reason that it should not be if every captain gives a proper amount of attention to the Admiralty Gunnery Practice circular just issued.

Chatham Dockyard.

The chief work at this yard appears to be the fitting out of vessels for the manœuvres, which are to commence in July. The *Sappho* has been taken in hand to have some defects seen to, and the *Vindictive* has also gone into dock to be prepared for sea. The *Tribune* has had a final overhaul of her under-water fittings, and is once again afloat, as is the *Endymion* The trials of the *Diana*, which are to consist of three trials of thirty hours' duration each, the first at 1,600 I.H.P., the second at 4,800 I.H.P., and the third at 6,400 I.H.P., have now commenced. An eight-hours' trial at 8,000 I.H.P. is included. The basin trial of her engines was most satisfactory, as were the experimental steam trials to test her consumption of feed-water. The defects of the *Grasshopper* have been attended to, and she has been undocked, and the *Slaney* has taken her place. The torpedo-boat destroyer *Spitfire* is also being prepared for sea. The repairs and alterations on the *Mersey* make good progress, and an effort is being made to get the *Sanspareil* ready to take part in the manœuvres. The *Dreadnought*, which has been in hand for the past twelve months, is now ready for sea. She has received a new armament and a new set of boilers, and her hull and machinery have undergone a thorough repair. The *Endymion* and *Astræa* are to hoist the pennant this month, and all defects on these vessels are now being attended to. The *Goliath* is to be ready for the pennant by September, her trials taking place at the end of this month, or at the beginning of next. The cruiser *Pioneer*, which was laid down on December 16th, 1897, is now ready for launching. Although she has been what is now regarded as a long time in building, she will be practically completed when she takes the water, and her steam trials will take place very shortly after this event.

The New Royal Naval College.

Work on the site on which the new Royal College is to be built, at Mount Boone, Dartmouth, is being actively carried on, and the architect, Mr. Aston Webb, A.R.A., recently visited the place himself to see what progress was being made. The Mount Boone estate is about 200 ft. above the river Dart, and the building which is to be erected on it will provide accommodation for 260 cadets and staff. The educational buildings form the central block, and contain a large hall, 90 ft. by 50 ft., with two floors of class-rooms on either side. On either side of the central block are the dormitory and day-room blocks, each block for 130 cadets. On the north side of these blocks are sanitary blocks. The block at the western end contains the cadets' dining hall, 80 ft by 40 ft. On the south side of this block, and towards the view, are the officers' ward, the mess-room, &c., with kitchens and stores complete. On the north side are the various mess-rooms for the petty officers and staff. The corresponding block at the other end of the building contains the captain's house, also with a southern exposure towards the view, and a chapel to hold 350 persons. The whole building, which has a southern frontage and a beautiful view towards the mouth of the Dart, is arranged in semi-detached blocks to secure ample proportion of air round each block. Sick quarters, with sixty beds, will be built to the west of the site, consisting of infectious and non-infectious blocks, an administrative block, doctor's house, and quarters for the infectious nurses. Some thousands of pounds have already been spent upon the place, and when the building is finished it will be one of the finest of its kind in England, although it has been suggested that it might have been built to hold a larger number of cadets.

The Work of the Navy Employment Agency.

The third annual statement of the affairs of the Navy Employment Agency forms very satisfactory reading. The Agency, which, it will be remembered, is carried on under the control and management of members of "The Castaways" Club, was instituted some three years ago for the purpose of finding employment for seamen who had left the Navy. A branch office has recently been opened at Portsmouth. The names of 1,063 applicants for assistance have been placed on the book since the agency has been instituted, and during the year ending March 31st last 250 men have found employment, an increase of twenty-two over that of the previous year: and indirectly the agency has found employment for from 130 to 380 men, which is also an increase on the previous year; 109 men are still on the books as unemployed. However, taking various conditions which prevailed during the two years into consideration, the committee are of opinion that the work is increasing in a marked degree. There is one point which cannot be too strongly impressed upon men seeking employment, namely, the harm done to the agency by men who throw up a billet before they have given it a fair trial, in some cases for very trivial reasons. This, in nine cases out of ten, has the effect of depriving the agency of the patronage of the employer who is thus treated, and so closes a channel of employment to other men. With regard to the finances of the agency, the committee have invested a further sum of £100 in the Post-office Savings Bank. The donations this year are £267 7s., as against £224 10s 7d. in the last report, and the annual subscriptions £152 18s. as against £105 14s.; a very gratifying increase. This invested capital is intended to be kept as long as possible as a provision for contingencies, and the committee do not propose to add to it further, but to expend any surplus funds towards extending the scope of the agency. The appeal for increased support ought not to be made in vain, for, if similar branches were established in other naval towns, much good would certainly result. The agency is willing to do its best to find employment for men of the engine-room complement, as well as of the seaman class.

Portsmouth Dockyard.

The *London* and *Pandora*, which are under construction at this yard, continue to make fair progress, but the completion of the *Gladiator*, *Canopus*, *Formidable* and *Andromeda* occupies the most attention. The progress of the work of completing the *Canopus* is somewhat slow, but practically the whole of her armour has been fitted. It was intended, if possible, that her trials should take place some time this month, but no date has as yet been fixed. There is very little other news to record except that the torpedo-net cutter, invented by the officers of the *Vernon*, has proved so successful that they are now turning their attention to the invention of a net which shall resist this cutter. The next step will probably be to invent a new cutter to break through the meshes of the new net when it is invented. Another invention from the *Vernon* is a cutter to sever the 6-in. wire hawser which forms part of the boom devised by the *Vernons* some time ago. About refits, it may be mentioned that the coastguard and portguard squadrons are this year to undergo a three months' refit, and that the defects will not be glossed over in the old sweet way. After this thorough overhaul, however, they are to be kept in such a state of efficiency that only a month will need to be spent upon their annual refit. The condensers of the *Trafalgar* are said to be completely worn out. An item of news that may interest many is that the band of native musicians which were employed on the *Renown* in the West Indies did such satisfactory work that they have been turned over to the *Crescent*, and are to serve another commission in her.

Our Naval Superiority.

The introductory article, contributed by Lord Brassey in the "Naval Annual" for 1899, will afford food for reflection for the naval "experts" of both France and Russia—if the latter country has any gentlemen of this profession. Lord Brassey says that if we compare the fleets in commission under the French and British flags, it will be seen that, both in the Channel and Mediterranean squadrons, in battleships the British fleet has an overwhelming superiority, while in cruisers we far outnumber the ships under the French and Russian flags. Lord Brassey sums up the official table of the comparative strength of the world's navies, and in doing so points out that the full superiority of the British Navy is not properly shown in a comparison of numbers without reference to dimensions. We have 24 ships of over 14,000 tons; 11 of between 12,000 and 13,000 tons; 10 of between 10,000 and 12,000 tons; 17 of from 6,500 to 9,100 tons; 24 of from 4,000 to 5,800 tons; and 46 of from 2,000 to 4,000 tons. Taking the ships of even date with the British, France has 11 of 11,000 to a little more than 12,000 tons, while Russia has only 9 ships of more than 11,000 tons. It is pretty well known that a French battleship of the same tonnage as a British battleship will cost a good deal more money, and, according to Lord Brassey, the difference is nearly £150,000. He also calculates that, although our cruisers of from 11,000 to 14,000 tons cost from £500,000 to £700,000, cruisers of inferior tonnage built for foreign navies cost from £800,000 to £900,000. Figures will prove anything, and it is a question whether it is advisable to make out in this way that we have such a great superiority over the navies of France and Russia. However, Lord Brassey's article is well worth reading, if only as an antidote to the alarmist letter sent round to the Press by the Navy League.

Building Up the French Navy.

The ridiculous manner in which the French Anglophobe organs have attacked the French Government for allowing Captain Jackson, the British naval Attaché in Paris, to pay a series of visits to the French naval ports, only goes to prove how slight their knowledge is of naval affairs. One would not think that a reasonable man would suppose for one moment that Captain Jackson, if he wished to unearth French naval secrets, would openly go down to the dockyards for the purpose. Practically anybody can get a permit to go over the French dockyards much in the same way as the English dockyards can be visited, and a statement of the number of vessels building in France with their dimensions is published every now and then in the local papers. At Cherbourg there are several vessels on the stocks or being completed. Among them are the *Henri IV.*, an ironclad of 12,700 tons, the submarine boats *Morse* and *Narval*, and the destroyers *Dunois*, *Fleurus* and *Lahire*; while at Brest the *Charlemagne* and *Gaulois*, of 11,200 tons each, and the *Iena* of 12,000 tons are being completed, and the cruiser *Suffren*, of 9,000 tons, is on the stocks. At Lorient the first-class cruiser *Gurrien-de-la-Graviere* and the gunboat *Decidee* are to be launched in June, and the cruiser *Gueydon*, of 9,500 tons, in September. The battleship *Saint-Louis*, 11,300 tons, is being pushed forward, in order that her trials can be made in the same month. As soon as the launches mentioned take place, two cruisers of 10,000 tons each are to be commenced. At Rochefort there are in hand the cruiser *Dupleix*, 7,700 tons, the *D'Estrees*, 2,500 tons, the *Protet*, 4,100 tons, and the gunboat *Zelee*; the last two are being prepared for sea. The armoured cruiser *Dupetit-Thouars* and the *Jeanne D'Arc*, of 11,300 tons, are in hand at Toulon, while there are six armoured cruisers of from 8,000 to 10,000 tons, a third-class cruiser, fourteen destroyers, and thirty-two torpedo-boats being built in the private yards.

The Edwards Air Pump Syndicate, Limited.—Owing to the growth of the business of the Edwards Air Pump Syndicate, Limited, and to Mr. Edwards requiring the whole of his offices for his practice and research purposes, the directors of the syndicate have provided the company with offices at 3, Crown Court, Old Broad Street, E.C. One of Mr. Edwards's assistants, Mr. Frank L. Rowe, has been appointed manager of the company, and correspondents are asked to address all future communications to the syndicate at Crown Court. Although the business is no longer conducted at Mr. Edwards's office, he is still managing director of the syndicate, and its business remains, as before, directly under his personal supervision.

THE NEW ROYAL YACHT "VICTORIA AND ALBERT."

ON the 9th of May the new Royal yacht, *Victoria and Albert*, was named and launched by H.R.H. the Duchess of York. The Duke of York was, unfortunately, unable to be present owing to indisposition, and the Duke of Connaught accompanied the Duchess of York instead. This vessel, which is from the designs of Sir William White, Director-General of Construction, was laid down at Pembroke Dockyard in the latter part of 1897. It is an interesting point to note that this is the third Royal yacht built at Pembroke during the last sixty years.

The present *Victoria and Albert* was launched at Pembroke in 1855; her length between perpendiculars is 300 ft.; length, over all, 338 ft.; breadth, 40 ft. 3 in.; mean draught, 16 ft 3 in.; and displacement, 2,470 tons. She is, as probably most people know, a paddle boat, and is fitted with engines of 3,000 I.H.P., made by Messrs. Penn, of Greenwich, which propel her at about 15 to 16 knots per hour, and in her early days she attained 16¾ knots per hour.

We have given these few particulars so that the present yacht may be compared with the new one that has just been launched. In the first place, she will be a radical departure in the matter of propulsion, twin screws being provided for this purpose. Her length between perpendiculars is 380 ft.; length, over all, 439 ft.; breadth, 50 ft.; mean draught of water under normal conditions, 18 ft.; displacement, 4,700 tons; and the maximum I.H.P. is 11,000. In the notice we gave of this vessel in our issue of January, 1898, we stated that special care was being taken to make the vessel very comfortable in every way, and at the same time to give her a reasonable speed. We believe that it is contemplated that her sustained sea speed in fair weather will be about 17 knots, and that she is to be capable of 20 knots on the measured mile trial of eight hours. Her coal supply is to be about 2,000 tons, which should be sufficient to steam from England to Malta at a speed of about 14 knots.

The engines, which are triple-expansion, consist of two sets of vertical inverted type, each set comprising four cylinders, and the moving elements are balanced according to the Yarrow-Schlick-Tweedy system. This latter provision has been adopted to reduce vibration in the vessel to a minimum. Each set of engines is to be placed in a separate water-tight compartment. The steam will be supplied by eighteen boilers of the most approved Belleville pattern, fitted with economisers in the uptake. There will be two stokeholds in separate water-tight compartments, each containing nine boilers. Special attention has been paid to the ventilation of the machinery and boiler departments.

A very complete electrical installation is to be provided, which will provide energy for lighting the whole of the ship, for working lifts, pumps, hoists for boats, ventilating fans, the after-capstan, and heating the principal apartments. It is anticipated that, by substituting electricity for steam in these auxiliary services, very great comfort, as well as high efficiency, will be obtained. The vessel will have a clipper bow, an elliptical stern, three tall raking masts, and two funnels; her hull is constructed of steel, sheathed with teak and copper, the teak sheathing being carried up to the upper deck and the copper sheathing to a little above the water-line.

The wood used in the bulkheads, fittings, and furniture is to be treated by a special chemical process to render it practically uninflammable.

The interior of the vessel is divided into a large number of water-tight compartments, and the hull has a cellular double-bottom extending from bilge to bilge; the double structure being practically extended up to and above the water-line by the coal bunkers.

The upper deck is 19 ft. above the water-line, and the State-deck about 10½ ft. More than half the length of the vessel on the State-deck is taken up by the apartments for the Queen, the members of the Royal family and their suites, and also for the commanding officer and principal naval officers attached to the vessel.

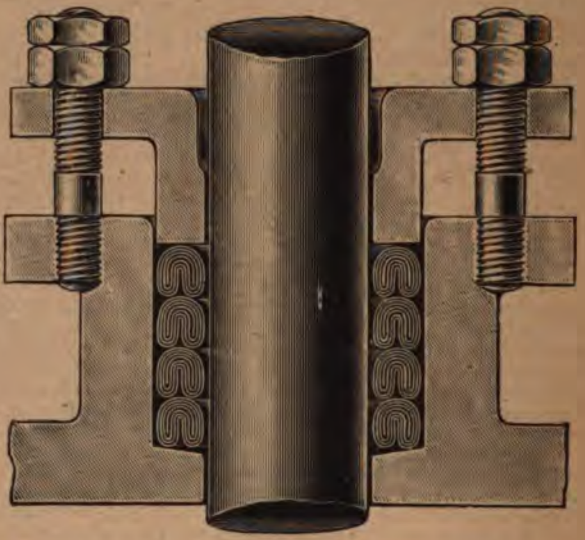
The sanitary arrangements have had special attention bestowed on them, and hot and cold water supply will be fitted in the bathrooms and principal sleeping cabins.

All the spaces on the lower deck which are for the accommodation of people, are provided with special ventilating side-scuttles capable of giving light and air under all circumstances, even in bad weather.

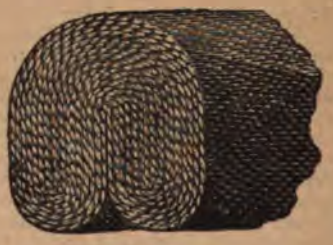
The vessel will be brought round to Portsmouth, when the machinery has been fitted and is ready for the steam trials, on the completion of which the furnishing and decoration of the yacht will be taken in hand by Messrs. Waring.

PLATTS & LOWTHER'S PATENT COMPENSATING SPLIT PACKING.

IT is a matter of common knowledge among engineers that much power is wasted through the medium of tight packing, also that under such circumstances the packing and rod wear rapidly away by reason of the friction set up between them. Many engineers have had the experience of practical evidence of this fact in case of an engine when newly packed refusing to stir even under the full boiler pressure.



We illustrate in the adjoining diagram a gland fitted with Platts & Lowther's patent compensating split packing, which we understand is the result of many years' practical experience in the direction of obviating the disadvantages above enumerated. It will be seen from the illustration that the packing consists of two or more layers in close contact with each other in a U form. The rings of packing are placed one above the other in the stuffing box in the usual manner, as shown in the illustration. This arrangement produces an element of considerable elasticity, which gives a tight sliding joint with a minimum of friction. The packing also possesses a compensating property, for, as the layer next to the rod wears, it is caused by the pressure of the gland and the wedge action of each layer of



packing on the next layer to be automatically replaced by fresh material, and in this manner a large portion of the body of the packing is thus utilised.

A feature in the use of this packing is that very little pressure is needed by the gland on the packing, in fact the nuts only need screwing down by the hand without the use of a spanner, which is due to the extreme elasticity of this packing.

This packing is, we understand, being used largely in Russia for high steam and hydraulic pressures, and from the copies of the testimonials we have seen it appears to be very satisfactory and highly appreciated. As an example we would refer to the case of some new blowing engines which were packed with this packing and after four years' constant running, night and day, the tools' marks were still visible in the rods, which is excellent evidence of the absence of friction between the rods and the packing.

This packing is put on the market by Messrs. Platts & Lowther, of 23, Lime Street, Fenchurch Street, London.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

THERE have been three papers read before the Institute of Marine Engineers during the month. The discussion on Mr. Nicholl's paper was finished at the previous meeting, and another on the comparison of the performance of two ships. This latter paper contained a great deal of data, but it could not be said that a comparison could readily be made, as neither the dimensions of the vessels, the lines were not the same. The H.P. required for each was very different. But one advantage of such a paper is very clear. It gives a record of what goes on in a voyage, and it is the kind of information which is interesting to marine engineers, and it also enlightens outsiders as to what goes on in a ship.

Mr. Lawrie was in the chair, and he expressed regret at the absence of Mr. Adamson, the honorary secretary. The paper was one which might be approached from a good many points of view. Mr. Halliday said at the beginning of the session he ventured to urge the desirability of obtaining papers from chief engineers of sea-going steamers in order that they might get detailed and reliable information as to what actually took place in the working of marine engines at sea. This was a paper that might not be of so much interest to the sea-going members, but to him and others similarly situated it was a paper of extreme interest and importance. More papers of the kind describing exactly what went on at sea would, he thought, be an excellent thing for the institution. Mr. Boyle remarked on the enormous difference in the results shown by the two steamers dealt with in the paper. The paper which came after this was also of some interest, since it settled several doubtful points which were raised in the discussion on water-tube boilers and feed-heaters. It will be remembered that one of those points was the effect of the velocity of the water through the tubes on the co-efficient of absorption of heat. Experiments have now been made on this point, and the results published in another part of the paper. The apparatus used was made very simple in order that the experiments could be performed by anyone else easily. But although the apparatus was made very simple, the results came out very satisfactory indeed. This simple apparatus easily showed that there is an increase of absorption of heat when the velocity of the water through the tube increases. But with steam where the heat cannot get quickly enough forward to the tube to supply heat as fast as the water in the tube can carry it away, it is different. There soon comes a point where there is a maximum absorption of heat, and then a rapid falling off as the velocity increases. But this maximum point depends on the kind of fire which is heating the tube. If a fierce fire, then the maximum point will be at a high velocity, and if less fierce the maximum point will come sooner. In one case the maximum point came at a little over a point which represented a velocity of 100. In another case it was nearer 150, and in still another case the maximum point came where the velocity was a little over 150.

There was another question which required solution. That was the question of the properties of the water just at the boiling point. It has been held by some that when water reached the boiling point it immediately developed new properties which enabled it to absorb heat at a much higher rate. Some experimenters, notably the French, held that at the boiling point a great increase of absorptive power took place, and M. Normand, before the Institute of Naval Architects, said that at this point the water absorbed three times as much heat as it did at other temperatures. The experiments made at the Institute of Marine Engineers to determine this question do not bear out the statements made by M. Normand or his French friends. A straight tube was taken through which the water could flow and boil, and it was arranged that the water should overflow from the tube and produce no circulation by currents in the tube; by this means any extra influence which the entraining action of the steam would have to produce more rapid circulation and more absorption of heat was prevented. When this was done, and bubbles of steam were freely given off at a temperature shown by the thermometer at 212 deg., with a circulation through the tube of 19·4 cubic centimetres per minute, the water absorbed 3113·7 thermal units. The trial was then made with the water running at a slightly higher velocity, just sufficiently high to stop the steam bubbles being formed. When this was done the temperature of the water fell to 202 deg., the average quantity of water flowing through the tube was 26·43 cubic centimetres per minute, and the number of thermal units going into the water as it flowed through was 3933·6 as against 3113·7 thermal units at the boiling point. Of course, the vessel used by the French experimenters was not suited for the experiment, as the effect of the circulation produced by the entraining action of the steam was not excluded.

The apparatus which is being made for new experiments is one which will first boil water in a vessel, and then allow it to flow into a second, where it will again be heated and kept at the boiling point. While kept at the boiling point it will circulate through this second vessel and be kept at the boiling point for a specified time. The first apparatus, presented by Mr. Hallett, has been on exhibition in London, and has been seen by eminent engineers with much satisfaction.

There are still further experiments to be made on the question of absorption of heat by water. Experiments have already been made by Mr. Hagemann, of Copenhagen, which are of some value, but they were made on different lines. And although his results would show that there would be a maximum point of heat absorption, he has not carried them far enough to demonstrate this point. It will be interesting to use a metal tube with gases playing on and the water moving very rapidly through it. Of course, the velocity at which the point of maximum absorption takes place will be very much higher, and there may be several other interesting points which the experiments can alone elucidate.

A very important series of articles has appeared in the *Engineer* on the naval boiler of the future. The last of the series is on the fire-tube boiler. As drawn it is of A shape with the fire between the legs. Water comes down the legs and through the legs of the A go fire-tubes at right angles to the sides. The hot gases thus flow through the tubes and ascend to the uptake from each side. The disadvantage of the fire-tube boiler, we are told, is that it is too heavy, due to its shell. It also carries too much water. It compares well, however, with the Belleville boiler, and a quotation is made from Herr Benischke on this: "Worked with all the care and attention necessary for the elaborate system described above, Belleville boilers have stood well at sea when not pushed, but as steam producers their results are not eminently good. What they save in weight of water, as compared with other water-tube boilers, is almost made up for by the weight of masonry in the furnaces, as well as of the feed air-compressing and steam-drying arrangements. At the trial trip of the Messageries Maritimes Co.'s *Australien* only 19·2 H.P. was obtained with one ton weight of boiler, whereas Scotch boilers produce 18 H.P. per ton with natural and 20 to 25 H.P. with forced draught." H.M S. *Hannibal's* Scotch single-ended boilers weigh 132 lbs. per I.H.P., and give 14·8 H.P. per square foot of grate. The Belleville boilers in the *Canopus*, working under similar conditions, weigh 103 lbs. per I.H.P., and the H.P. per square foot is only 12·9. The H.P. of the *Canopus* is about 21·7 per ton. Mr. Howden has obtained 25 H.P. per ton. The weight per square foot of grate of a Scotch boiler is given by M. Bertin as ·85 ton, of the Belleville ·53 ton, and of the Niclausse ·466 ton.

In the proposed fire-tube boiler which the *Engineer* gives in sketch the fire-tubes are 1 ft. 6 in. long and 1¼ in. outside diameter. And the argument is, the first inch or two of tube give as much evaporation as the last foot or two. They propose to set 36 tubes in a square foot of surface. The side is taken 7 ft. long, and its width 4 ft., so that on each side there are 28 square feet available. This gives 1,008 tubes, or 2,016 tubes in all. The spaces between are ¾ in., which is quite sufficient in a locomotive boiler using bad water. The area of each tube is ·5 square feet, and the total area 1,050 square feet of heating surface of maximum efficiency. The grate surface is about 30 square feet, and the ratio of heating surface to grate area about 35 to 1. They go on to say, "The Belleville generator is not to be the naval boiler of the future; it is a stop-gap, and nothing more." The articles close with an extract from Sir John Durston's paper: "The battleships have been tried with tank boilers. . . . and are all arranged to develop 10,000 I.H.P. with natural draught, and 12,000 I.H.P. with accelerated draught. . . . All these battleships obtain their maximum power by forced draught, fitted on the closed stokehold system, with the exception of the *Magnificent* and *Illustrious*, where fans in the uptakes are fitted on the system known as induced draught. The amount of forcing as indicated by the air pressure or vacuum required is but moderate, and the maximum powers were easily obtained. The boiler tubes are all fitted with the Admiralty cap ferrules, and leaky boiler tubes, once so fruitful of trouble in warships, are now practically unknown."

If numbers of attendance show success, then the address given by Sir William White at the opening of the session of the Mechanical Engineers was a great one. The subject was the connection between mechanical engineering and modern shipbuilding. Sir William made a division of his subject under several heads, such as steering, capstans, windlasses, and cable gear, &c. Under steering, the palm of efficient steering gear was given to Mr. Macfarlane Gray. The first steps were taken by Mr. Gray in 1866, as the result of difficulties that had occurred in steering the *Great Eastern*. Mr. Gray's invention of the differential gear enabled the steering engine, when placed at a distance from the navigating station, to be controlled by the movement of the steering wheel, so that the helm could be made to follow and assume any desired position. The successful trial of the *Great Eastern* led to the general adoption of steam-steering gear. The Admiralty took it up, on the advice of Sir Nathaniel Barnaby, and applied it to the *Minotaur* class. With manual power 18 men were employed at the wheel, and 60 at relieving tackles. They took one and a-half minutes to put the helm over to 25 deg., and seven and two-third minutes in turning the ship through 360 deg. With steam-steering gear two men at the wheel put the helm over 35 deg. in 16 seconds; the ship turned in five and a-half minutes, and in two-thirds the space.

ELECTRICAL NOTES.

(*From our own Correspondent.*)

THE United States army transport *Hooker* No. 1 is being fitted as a cable ship for service in the Philippine Islands. These islands are to be connected by the United States Government by cable, and about 240 miles of it will be sent out by the *Hooker* about May 1st. Nearly all the interior fittings of the ship have been removed, and three tanks for cables installed, also refrigerating rooms and appliances for the transport of fresh meat. The forward cable tank is 13 ft. in diameter and 8 ft. high, and has a capacity for 60 tons of cable. The midships tank, 24 ft. by 13 ft., has a capacity for 400 tons, and the after tank, 26 ft. in diameter and 6 ft. deep, will contain 240 tons, the total capacity being 700 tons of cable. The tanks are built of boiler iron with cabled joints, so as to be watertight. When the cable is coiled in place it is covered with sea water to serve as an outside connection, and to preserve the cable, which deteriorates rapidly when exposed to the air There is a winding gear fixed on the deck forward, which consists of a drum about 8 ft. in diameter, supplied with brakes and the usual accessories for cable work. Under the pilot-house is the cable testing room, fitted with galvanometers, in constant connection with a small battery and the cable; there are also fitted Wheatstone bridges *and* Kelvin marine galvanometers. The refrigerating plant can suit 150 quarters of beef, and the ship will thus be of use as a supply ship. The electric light plant consists of two 175-light units, each composed of a dynamo direct-coupled to an engine. The *Hooker* will have a cruising speed of 13 knots. She is 333 ft. over all, 33 ft. beam, about 2,000 tons burden, and has an engine of 1,600 I.H.P. for working a single screw. The forecastle has been heightened about 6 ft., herein are mounted two Hotchkiss six-pounder rapid-firing guns, to deal with the pirates of the Sulu seas, and 75 stands of arms are also carried. The officers and men number 150.

As early as 1833 Jacoby had an electric boat running in the Neva at St. Petersburg. It was very crude. There were primary batteries and an old rotary motor. Things have advanced since then. A very good and efficient electric-motor-driven launch has been fitted out in the United States lately. The motor is fitted in abaft the after bulkhead, which leaves the seat space entirely free of obstruction. There is no unseemly chimney shown, and no heat shows dangers of fire and explosion like those which accompany the steam and oil engines. Another advantage is that one man can run the boat himself. The control is effected by grouping the battery in various combinations. The controller axle projects through the hollow shaft of the steering wheel, and terminates in a small hand wheel directly in front of the steering wheel. When this hand wheel is moved in one direction, the boat goes ahead; when in the other direction, astern. There is a ball bearing thrust block in one of its journals, and the whole structure is watertight below the shaft line. There is no gearing—connection of the motor is made direct to the shaft through a split coupling. The storage battery consists of elements in hard rubber cells, having a special watertight cover to keep out the sea. The cells are collected in porcelain blocks, air spaces being left between the cells.

Wireless telegraphy, which appears destined to be of such service to the mercantile marine, is not so new as people would suppose. So far back as 1831 James Bowman Lindsay, of Dundee, actually conveyed messages across the Tay river. Lindsay was a weaver. But he had the gift of study so common to the humble Scotchman, and became ultimately a science teacher. In 1835 he showed an electric lamp in Dundee. His method is explained in the report of the British Association, 1859. The report says, "he succeeded in transmitting signals across the Tay and other sheets of water by the aid of the water alone as a means of joining the stations. His method is to immerse two large plates connected by wires at each side of the sheet of water, and as nearly opposite to each other as possible. The wire on the side from which the message is to be sent is to include the galvanic battery and the commutator or other apparatus for giving the signal. The wire connecting the two plates at the receiving station is to include an induction coil or other apparatus for increasing the intensity and the recording apparatus. The distance between these plates he distinguished by the term 'lateral distance.' He found that there was always some fractional part of the power from the battery sent across the water. There were four elements on which he found the strength of the transmitted current to depend: first, the battery power; second, the extent of surface of the immersed metal struts; third, the 'lateral distance' of the immersed struts; and fourth, in an inverse proportion the transverse distance, or distance through the water. As far as his experiments led him to a conclusion, doubling any one of the former three doubled the distance of transmission. If then, doubling all would increase the intensity of the transmitted current eight-fold, he entered into calculations to show that two stations in Britain, one in Cornwall the other in Scotland, and corresponding stations well chosen in America, would enable us to transmit messages across the Atlantic." Lately the *Pall Mall Gazette* has been publishing the views of persons interested in Marconi's system of wireless telegraphy, in which they express their belief that communication with the United States by means of the system is practicable. It adds, "There is no intention of competing with land lines." The *Electrical Review*, New York, says, "There is no doubt that the company will not compete with sea-lines either." It makes a calculation, and says, "the distance from London to New York is about 74 degrees 50 minutes of the arc of the earth's great circle. Taking the radius of the earth to be 4,000 miles, the towers at the two ends of the line would have to be 1,038 miles high—and even then the messages would graze the surface of the Atlantic."

The submarine cable has had a rapid career since the first was laid across the English Channel in 1851. The only seas under which the cable does not lie, are those of the middle Pacific, and these also will soon be traversed. There are at present 1,460 cables laid, 1,142 of which are owned by nations, and 318 by companies. The total mileage is 166,299 nautical miles, enough to reach eight times around the earth on a great circle.

One of the principal features of the electrical exhibition of New York will be Government exhibits, in which will be found apparatus belonging to the Army and Navy service corps and the Weather Bureau; a searchlight from the Spanish cruiser *Vizcaya*, taken from the vessel after the naval fight at Santiago, together with a searchlight taken from the *Maine*. The "Navy Standard" of wiring will be in evidence, showing special cut-outs, branches, and switches.

The Nernst Lamp has been very much in evidence lately, and it is said the incandescing rod in a 400-volt lamp should be 1⅜ in. long. The cost of lamps is said to be 5 dollars to replace ordinary arc lamps. The watts required is 1·5 to 1·6 per candle, which lies between those of arc lights and incandescent lamps. The colour of the light is whiter than glow lamps', and approaches that of the arc lamp. The life of the rods is 500 hours, and their renewal is not very costly. The temperature of the arc is 3,000 deg. Centigrade. Lamps as small as 20-candle power can be made for 400-volt circuits.

Quite a number of wonders have come upon us in the electrical line lately, and one of the most wonderful, perhaps, is the picture by telegraphy. The *Electrical Review*, New York, reproduces one of these pictures, which is a portrait (one-half original size) received at New York from St. Louis over 1,550 miles of line and one repeater—reproduced without retouching. Pictures made in this way depend on the synchronism of apparatus at the two ends of the line, and the difficulty of obtaining this has delayed the successful manipulation of the business for so long. Biene and Cassini used pendulums at the ends of the line. The machines used have been fitted up in newspaper offices in the cities of St. Louis, Chicago, Philadelphia, New York, and Boston, and the photograph shown was made in the *New York Herald* office. Mr. E. A. Hummel is the inventor. Two cylinders of equal size are fitted in the machine at each end. The drawing at the sending end is made on a piece of stout tinfoil in an insulating ink. This is wrapped about its cylinder, and turned under a platinum point, which makes contact with the tinfoil except where it crosses one of the lines of the ink drawing. At this point the circuit is interrupted momentarily. At the receiving end a similar cylinder, turning synchronously, has upon its surface a sheet of paper covered with carbon impression paper, outside of which is a sheet of thin semi-transparent paper, and the break-circuit signals operate a stylus which is pressed upon this surface, so producing the lines of the drawing. The cylinder is driven at a steady speed of 14 revolutions per minute by clockwork similar to an astronomical driving-clock, and controlled by a Faraday wind-vane governor. The platinum point bears lightly upon the surface, and is carried upon a carriage similar to that of a lathe. At each revolution of the sending cylinder, a pivot upon it engages in a ratchet upon the head of the carriage screw, and moves the platinum point forward by an amount dependent upon the pitch of the ratchet. There are four ratchets, which can be set in the carriage screws of both receiving and sending instruments, and both the size of the cylinder to be used and the coarseness of the ratchet to be put in gear are agreed upon by ordinary telegraphic correspondence. The clockwork at each end is driven by a weight and an endless steel belt. A winding drum, moved by an electric motor, winds up at each revolution enough of the slack to keep the apparatus constantly moving. When either the sending or receiving carriage has reached the end of its travel, an automatic stop throws the instrument out of circuit. Three sizes of cylinders are in use, and four speeds of travel. The picture shown was received in about 26 minutes. It is possible to send a picture from one station and have it received simultaneously in the other four.

The Island of Bornholm, in the Baltic Sea, is said to consist of magnetic iron ore, and sailors have long dreaded its influence on their compass needles. The effect is felt for distances of miles, and on sighting the islands the mariners begin to steer by the aid of the lighthouses. It is said that a magnetic needle in a boat close by the island takes a vertical position.

At a recent meeting of the Institute of Marine Engineers to discuss the paper read by Mr. Nicholls an expression as to the want of data on electric motors for deck machinery was given. The following table, which is given by Mr. Alton D. Adams, on the efficiency of small motors may be of interest.

Watts delivered.	H.P. delivered by motor.	Watts lost in armature.	Watts lost in coils.	Watts lost in currents.	Efficiency.
548	½	40	44	91	68 per cent.
995	1	65	60	134	75 ,,
1,913	2	110	99	212	78 ,,
2,798	3	130	110	320	80 ,,
4,548	5	170	176	473	82 ,,
6,661	7½	220	220	626	84 ,,
8,674	10	260	264	690	86 ,,

A steam engine of 5 H.P. does not give anything like an efficiency of 82 per cent.

OIL MOTOR BOATS.

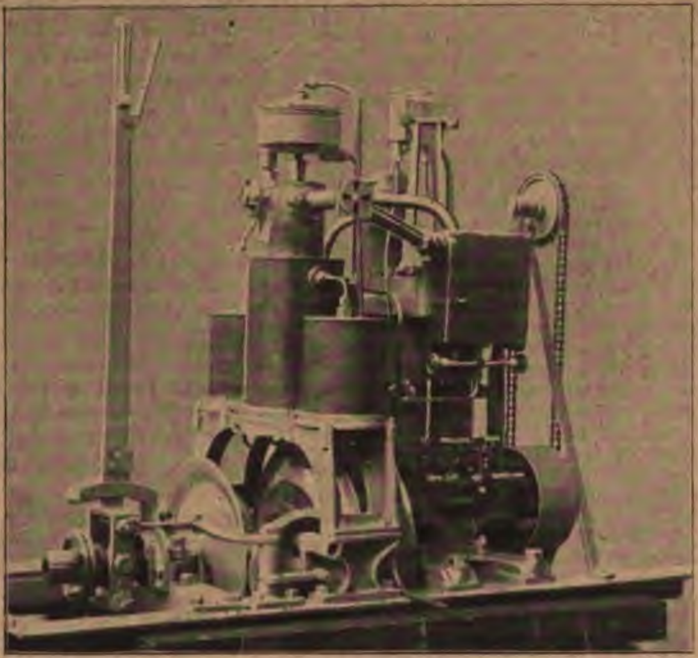
FOR small launches where the people in them have to sit in the open, and where, if coal were used, they would be smeared by coal-dust and smoke, a spirit or oil motor appears to be the proper arrangement. Less space is required for the fuel, and the boat itself can be kept tidy and clean. Two such boats are to form part of the equipment of a steamship of the American Line, when she leaves on a cruise to the West Indies. The dimensions of the boats are:—Length, 30 ft.; beam, 8 ft.; keel, white oak sided, 3 in.; moulded at fore end, 4 in.; at stern, 6 in. stem of white oak; stern post and over-hang of quartered white oak; span, 11 in.; centres, steam bent sided, 1¼ in. The boats will have open seats and lockers provided in the motor-room. A 12 H.P. alco-vapour will be fitted, and the tank capacity will be two barrels. There is to be a double tow just aft with crosshead for towing the ordinary boats for landing parties. There is also to be a steering wheel and chain gear.

Another type of motor for a launch was on view at the Aquarium, and is manufactured by the Motor Carriage Supply Co. It is attached to the shaft in the usual way, but there are ahead and astern gearing fitted between the motor and the propeller shaft. This reversing gearing consists of conical pulleys. Ahead cone (2) is pushed against ahead cone (1) by the lever going forward. The engine runs free by the lever being placed in the middle position; and, when the motion is to be reversed, the lever is drawn back, the cones are separated, and the bevel gearing in the jack-in-the-box comes into play and reverses the direction of the propeller. Deep ribs are attached to the cylinder to assist in carrying away the heat, and there is a cowl on the top which blows down air in the cylinder to assist in cooling the cylinder, and this, of course, is increased as the speed of the boat increases.

The advantage of an oil motor to the owner of a launch is that a boiler is not required, and there is no smoke from the chimney. In fact, a chimney is placed on such a boat to make it like its neighbours driven by steam. But the chimney is a superfluity, as there is no smoke to carry away. Then the heat of the boiler and the dirt produced by the use and handling of coal is done away with.

The difficulty with such engines was the reversing of the motion, for it is a *sine qua non* that a marine engine must be capable of being reversed. In the case of the Parsons rotary system an extra engine had to be fitted in the turbinia to reverse the motion of the boat. In the case of the Daimler launch engine a very simple principle of mechanism has been applied for producing the reversing motion. That mechanism is a system of bevel wheels constructed of cast-iron.

There is a bevel wheel fixed to the main shaft of the engine, which is turned with a conical bevel on the outside and also a conical bevel on the inside of the rim, which acts as a friction clutch. This wheel is covered with leather. The side bevel wheels are covered with rubber. A lever which runs in the direction of the shaft moves the bevel wheels in and out of gear. When the lever is moved towards the engine it puts the shaft in gear, and also by means of links it pulls the two side bevel wheels out of gear. When the lever is pulled back, it pulls the inner bevel wheel out of gear, and puts the side indiarubber-clad bevel wheels into gear.



Daimber Oil Motor.

The fuel used is benzine of ·680 to ·700 specific gravity, which costs 11d. per gallon in London. The cost of running is about 1¼d. per actual H.P. per hour. A 4-H.P. engine costs about 6d. per hour in oil to run it.

But the oldest form of this type of marine motor is the Priestman engine. This is made in two types: the single-acting, which is made in sizes of 4 I.H.P. to 22 I.H.P.; and the double-acting, made in sizes up to 90 I.H.P. In the former an impulse is obtained for each revolution, and in the latter type two impulses per revolution—in each case the Otto cycle is used.

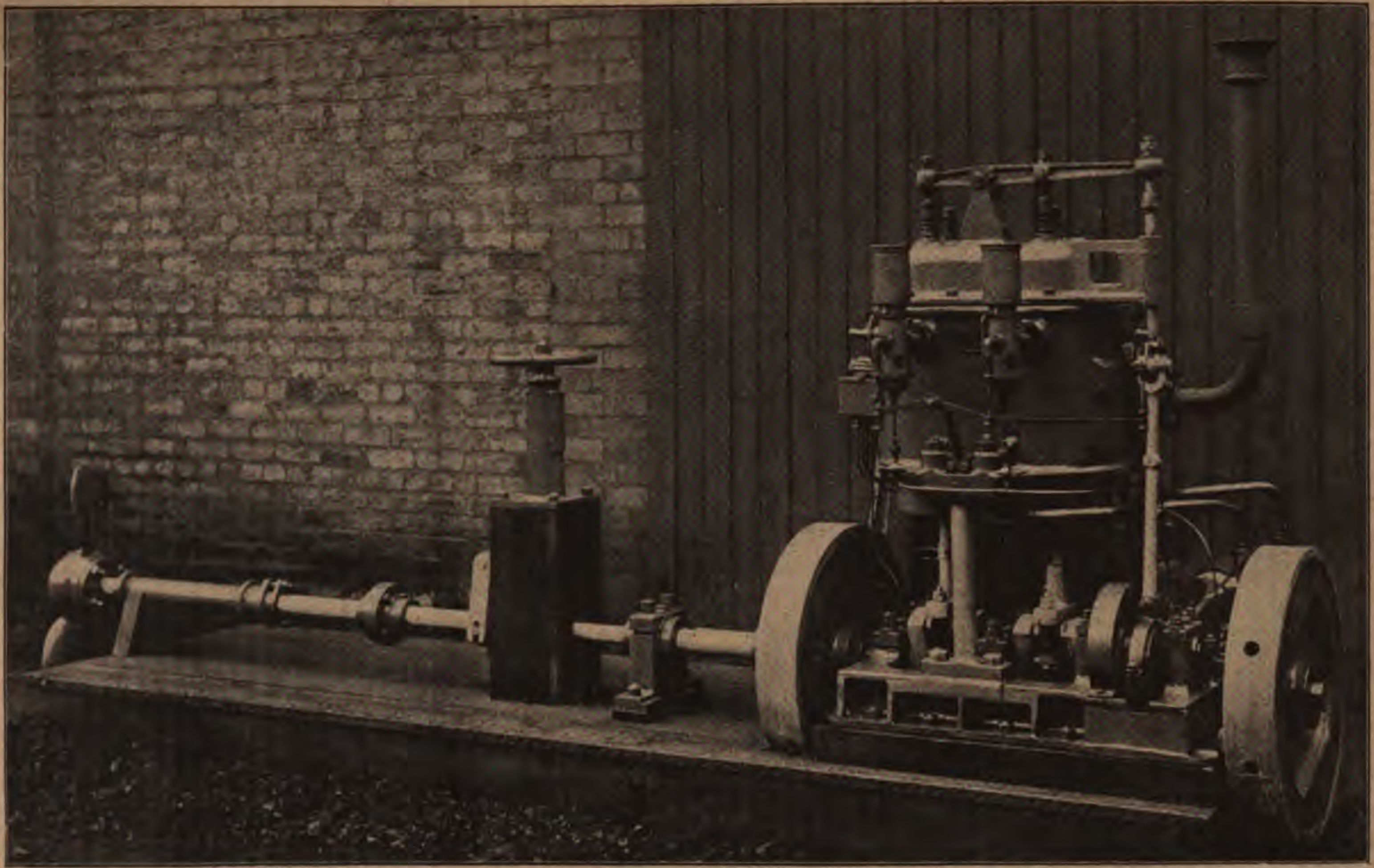
The mode of working is as follows:—Ordinary lamp oil, contained in a tank forming the engine bed, is *sprayed,* mixed with atmospheric air, vaporised and exploded in the cylinders by means of an electric spark or alternatively with a hot tube.

The engine is effectively governed on the "graded charge" principle by an apparatus which automatically regulates the supply of oil and air to the cylinders. Lubrication is effected by the condensing of the oil vapour on the walls of the cylinders.

A very simple and efficient form of self-starter is adopted, which renders the setting of a large engine in motion an easy matter. This consists of a hand air-compressing pump, by means of which a charge of air can be compressed and passed into one of the two motor cylinders, carrying with it an oil spray vapour, and giving sufficient pressure in the combustion chamber to give the engine a kick-off. In starting the engine has to be heated up for about fifteen minutes, and subsequently the heat in the vaporising chamber is automatically maintained by means of the exhaust gases.

As the rotation of the engines is always in the same direction, and the engines are kept going at the same speed, alteration in the speed and direction of motion of the boat is effected by means of the McGlasson patent reversing propeller, the blades of which are feathered, and thus any speed can be almost instantly obtained, from "full speed ahead" to "full speed astern." This regulation of speed can easily be controlled by the steersman; and, as the engine requires practically no attention whilst running, the whole boat can be managed by one man exclusive of the man at the wheel.

They have been supplied for barges, fishing-boats, and as auxiliary power in sailing vessels with great success. One pair was fitted in a 30-ton yacht belonging to Mr. Fred. Maden, of 34, Norwood



PRIESTMAN'S MARINE OIL MOTOR.

Avenue, Southport. During two seasons they cruised through Wales, the Isle of Man, Ireland, and the North of Scotland, and ran between 4,000 and 5,000 miles. The owner of the yacht says there is no priming in rough weather, no racing of the engine when the propeller is out of the water, and a great saving of space usually taken by a steam engine and boiler. Another, of 5 H.P., was fitted in a launch belonging to Mr. E. O. Dykes, Hessle, East Yorks. It has run for two seasons, and during the last two was worked by his gardener. The economy of space for engine and fuel was a great advantage, and after running the whole of two days had sufficient oil left from one supply to run a third.

The cost of working of this oil marine motor is a distinct advantage, for it does not require expensive oils, but the ordinary petroleum lamp oils. Careful trials by Professor Unwin showed that the cost per I.H.P. for oil was ·43d., and ·5d. per effective brake H.P.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

April 22nd, 1899.	Gibson, David	Ex. 1C	Liverpool
,, ,, ,,	Hewer, James	Ex. 1C	Hull
,, ,, ,,	Laird, A. M'K.	Ex. 1C	London
,, ,, ,,	Moffat, Wm.	Ex. 1C	Liverpool
,, ,, ,,	Pride, W. E.	Ex. 1C	,,
,, ,, ,,	Reynolds, H.	Ex. 1C	London
,, ,, ,,	Robertson, T.	Ex. 1C	Glasgow
,, ,, ,,	Scott, A.	Ex 1C	North Shields
,, ,, ,,	Shephard, W. H. ..	Ex. 1C	London

NOTE.—1C denotes First Class; 2C Second Class.

April 22nd, 1899.

Angus, Robt. G.	2C	Glasgow
Barton, Edgar	2C	London
Colquhoun, WH	1C	Glasgow
Doherty Michael	1C	W. Hrtpl.
Dunsmuir Alan	1C	Glasgow
Edward, Fredk.	2C	Glasgow
Gales, Walter J.	2C	Liverpool
George, S. W·	2C	W. Hrtpl.
Gordon, D. L.	1C	Liverpool
Grant, W. P.	2C	Dundee
Hill, Ernest W.	2C	Cardiff
Hill, Herbert W.	1C	W. Hrtpl.
Jack, Wm.	1C	London
Jacobs, F. C.	2C	Dover
Johns, Wm. ..	1C	W. Hrtpl.
Kitching, Tom	1C	,,
Lander, John ..	2C	Plymouth
Lees, Robert ..	1C	Glasgow
Leng, John G.	2C	N.Shields
Littlefield, G. S.	1C	,,
Marshall, T. W.	2C	W. Hrtpl.
Maxwell, Robert	2C	,,
Minns, H. W.	2C	London
M'Inroy, Alexr.	1C	Glasgow
M'Lean, Hector	1C	,,
Pavey, Jas. P.	2C	Cardiff
Ross, Jas.	2C	Glasgow
Smith, Wm. A.	2C	,,
Stephenson, R.B	2C	Liverpool
Thackray, E. J.	1C	London
Thornton, J. H.	1C	W. Hrtpl.
Walker, Jas. G.	1C	N. Shields
Walker, W. A.	2C	Cardiff
Watkins, R. E.	2C	London
Williams, Chas.	2C	N. Shields
Williams, Jas. O.	2C	Liverpool

April 29th.

Anderson, J. B.	2C	N.Shields
Brewer, Jas. H.	1C	Sun'rland
Buchanan, G. H.	2C	Liverpool
Clark, Reuben..	1C	London
Clinchen, W. G.	1C	London
Coxon, Mark M.	2C	N.Shields
Dunsmore, Wm.	1C	London
Edward, H. A.	2C	Sun'rland
Hall, Joseph ..	1C	N.Shields
Hosie, Wm. J.	2C	Aberdeen
Hughes, Percy	2C	Liverpool
Hyde, F. W. ..	2C	Hull
Hyman, Arthur	2C	London
Keynon, T. W.	1C	Liverpool
Limpright, C.W.	2C	N.Shields
Mansell, F. H.	1C	Liverpool
Manser, G. W.	2C	London
Mason, Alfred	1C	,,
M'Hardy, J. ..	2C	Aberdeen
M'Hattie, J. G.	2C	,,
Paterson, H. T.	2C	London
Pollock, James	2C	L'd'nd'r'y
Pratt, George..	2C	Sun'rland
Ramsay, John	1C	Liverpool
Reid, Thos.....	1C	Aberdeen
Seldon, R. N.	1C	London
Simpson, R T.T.	2C	Aberdeen
Smith, Wm. H.	1C	Aberdeen
Sneddon, W. R.	2C	London
Strain, James..	1C	Aberdeen
Thomas, J. E.	2C	Liverpool
Trotter, M.	1C	Sun'rland
Wilson, John O.	1C	,,
Wilson, Wm. H.	2C	,,

May 6th.

Anderson, John	1C	S'h'm'ton
Barnett, John E.	2C	Liverpool
Boag, James ..	2C	N.Shields
Dunn, R. A. J.	1C	,,
Frazer, John E.	1C	,,
Fright, Geo. O.	2C	Liverpool
Garratt, G. J.	2C	,,
Gray, Chas. J.	2C	,,
Green, Thos. ..	1C	,,
Harrison, N. ..	1C	,,
Kerr, John P. ..	2C	N.Shields
Longstaff, T. W.	1C	N.Shields
Maitland, Hy.	2C	Glasgow
Malcolm, Andw.	2C	,,
Martin, Geo. W.	2C	S'h'm'ton
Martin, M. E. ..	2C	Cardiff
Mathieson, Wm.	2C	London
Morgan, Wm. L.	1C	Cardiff
Myhill, Wm. C.	2C	London
O'Bryan, Peter	2C	,,
Prior, Stanley..	2C	Glasgow
Rankin, David	2C	,,
Riddell, Andrw.	1C	Liverpool
Roebuck, W. H.	1C	N.Shields
Stuart, John ..	2C	,,
Walker, Geo. H.	2C	Liverpool
Yuill, James ..	1C	Glasgow

May 13th.

Baillie, Donald	2C	Greenock
Barron, Rob. S.	1C	Liverpool
Batty, Wm.....	2C	Hull
Beadle, E. W.	2C	N.Shields
Black, John....	1C	Greenock
Boyd, Fredc. J.	1C	Hull
Brown, John ..	2C	Dublin
Carnduff, Wm.	1C	,,
Crabb, Thomas	2C	Greenock
Craig, Richard	1C	Dublin
Davies, David..	2C	Leith
Easton, Alex...	2C	Greenock
Harrison, T. D.	1C	N. Shields
Hepworth, A. H.	2C	London
Innes, Peter....	1C	Greenock
Iron, Walter L.	1C	London
Jackson, Wm...	1C	N Shields
Milne, John J.	1C	Leith
Mitchell, Charlie	2C	Liverpool
Moore, Wm. ..	2C	,,
Newell, L. C...	1C	Leith
Palmer, H. W.	2C	London
Paterson, W. J.	1C	Liverpool
Plimmer, Jn. D.	2C	London
Rickman, B. ..	2C	N.Shields
Roberts, G. A.	2C	Dublin
Roberts, Owen	2C	Liverpool
Robertson, Alex.	2C	London
Sendall, John H.	1C	N.Shields
Stiles, Chas. E.	1C	,,
Wilson, Albert..	2C	London

May 20th.

Allen, Thos. ..	2C	Cardiff
Anderson, John	1C	N.Shields
Armstrong, G.M.	2C	,,
Boudouris, B.M.	2C	Cardiff
Brown, William	2C	Liverpool
Buttar, Wm. L.	1C	Dundee
Chapman, H. ..	1C	N.Shields
Chittock, W. H.	2C	London
Christie, J. G.	2C	W. Hrtpl.
Cockayne, Fred	1C	Liverpool
Crozier, John P.	2C	W.Hrtlpl.
Dryden, Wm...	2C	Dundee
Duncan, Alex...	2C	Liverpool
Edwards, S. E.	1C	Cardiff
Fisher, Hugh ..	1C	Glasgow
Gibson, Robert	1C	,,
Grylls, A. G. ..	2C	Liverpool
Jaffrey, J. D. ..	1C	London
Jones, Albert W.	1C	,,
Kelly, Peter ..	1C	Liverpool
Laurie, W. K...	2C	London
Martin, Wm. ..	2C	N. Shields
Mavromatis, J.	1C	Cardiff
M'Cleod, Thos.	1C	W. Hrtpl.
McNaughton, W.	1C	Dundee
Morris, Griffith	1C	Liverpool
Nicholson, A. J.	2C	N.Shields
Parsons, W. S.	1C	London
Potter, John ..	1C	W. Hrtpl.
Pratten, F. E...	2C	London
Scott, Arthur L.	1C	Glasgow
Smith, W. S. ..	2C	N. Shields
Storer, Edwin B.	1C	W.Hrtlpl.
Watt, W. H. ..	1C	,,
Whitelaw, Thos.	2C	Glasgow
Wright, A. V. ..	2C	Cardiff

The Magnolia Anti-friction Metal Company and Others v. Sugden and Others.—Mr. Justice Mathew, in delivering his considered judgment on Thursday, May 11th, said that he had received a letter from Mr. Sugden, stating that he had sent to the plaintiffs' solicitors the assignments, after executing them, and that he was prepared to submit to his Lordship any question that might arise between him and the plaintiffs in relation to their form. His Lordship hoped that no such question would arise, but if so, there would be liberty to apply. His Lordship went on to say that he had to determine what the damages ought to be, as the result of this long litigation. The question was what damage had been sustained by a breach of the contract of 1891. If that contract had been fulfilled, what would the position of the plaintiffs have been? The defendants had been selling an inferior metal for £30 or £40 a ton, not half as good as the metal of the plaintiffs. In point of fact what the defendants were attempting to do was to compete with the plaintiffs by the manufacture of inferior metal. What they did was, first, to put forward a quantity of counterfeit metal, but in respect of that very discreditable conduct, an action had already been brought against them. Further, they sold 325 tons of inferior metal, and his Lordship had to consider what the position of the plaintiffs would have been if the partnership, instead of breaking their contract, had properly surrendered and given back the business to the plaintiffs. What would the plaintiffs have sold of their superior metal? He was not satisfied that he ought to go beyond about 200 tons per annum, and in three years that would amount to about 600 tons. The quantity actually sold by the plaintiffs was 463 tons, and the difference, therefore, was about 140 tons. Some £35 a ton would be the profit which would have been received by the plaintiffs if the contract had not been broken, and if the business had been handed back as it ought to have been. Some addition must be made for the expenses to which the plaintiffs had been put in order to recapture their business. His Lordship arrived at the conclusion that his judgment ought to be against the defendants for the sum of £5,500 and costs.

NAVAL ENGINEER APPOINTMENTS.

THE following appointments have been made at the Admiralty from April 25th to May 24th, 1899 :—

Aborn, G., fleet engineer to the *Pembroke*, for the *Sutlej*, to date May 13th.

Burnett, W. C., chief engineer, has been advanced to the rank of staff engineer.

Butcher, J. B., engineer to the *Vivid*, for the *Decoy*, undated.

Coad, H. J., chief engineer to the *Duke of Wellington*, for special service, to date May 1st.

Cudlip, E. W., chief engineer to the *Vivid*, as overseer at London and Glasgow Shipbuilding and Engineering Company, to date May 13th.

Dalrymple, J. H., chief engineer to the *Blonde*, to date May 16th.

Darley, A. C., engineer to the *Vernon*, for the *Jaseur*, to date May 13th.

Davis, H., assistant engineer to the *Benbow*, to date May 19th.

Dawson, T. J. (acting) engineer to the *Resolution*, undated.

Duffell, W. J., engineer to the *Pembroke*, for the *Janus*, to date May 19th.

Edgar, E. J., chief engineer, has been advanced to the rank of staff engineer.

Edwards, E., engineer to the *Pembroke*, for the *Desperate*, to date April 18th.

Fleetwood, J. L., acting chief engineer to the *Antelope*, to date May 4th.

Glen, W., assistant engineer R.N.R., has been promoted to the rank of engineer.

Gordon, F. A., assistant engineer to the *Pembroke*, for the *Astræa*, on recommissioning, to date May 19th.

Green, D. P., engineer to the *Royal Sovereign*, for the *Banshee*, undated.

Guyer, T. S., engineer to the *Centurion*, for service at Wei-hai-wei, to date May 5th.

Hall, A. C., assistant engineer to the *Pembroke*, for the *Astræa*, on recommissioning, to date May 19th.

Hardcastle, C. V., engineer to the *Vivid*, as instructor in working machinery of torpedo-boats, to date May 19th.

Hart, Alfred, chief engineer to the *Astræa*, to date June 15th.

Hean, H. G., engineer R.N.R., to the *Duke of Wellington*, for course of instruction, to date June 6th.

Hume, A. G., to be assistant engineer R.N.R.

Jose, F. W. R., engineer to the *Vivid*, for the *Sunfish*, to date May 19th.

Juniper, W., chief engineer, has been advanced to the rank of staff engineer.

Kingsnorth, A. F., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Kingsnorth, A. F., chief engineer to the *Harrier*, to date April 1st.

Kingswood, R. W., engineer R.N.R., to the *Duke of Wellington*, for course of instruction, to date June 6th.

Main, R., engineer to the *Duke of Wellington*, for the *Kestrel*, to date May 5th.

Mandling, W. J., fleet engineer to the *Duke of Wellington*, for the *Cordelia*, to date May 5th.

Morley, H. S., assistant engineer to the *Colossus*, to date May 19th.

Moysey, A. H., engineer to the *Pembroke*, for the *Swordfish*, to date April 11th.

Murdoch, H. C., to be assistant engineer R.N.R.

Pedrick, J. R. J., staff engineer, has been advanced to the rank of fleet engineer.

Plant, S. L., to be assistant engineer R.N.R.

Ramsay, Walter, engineer R.N.R., to the *Duke of Wellington*, for course of instruction, to date June 6th.

Rawsthorne, G., to be assistant engineer R.N.R.

Reid, W., to be engineer R.N.R.

Rule, R. T., engineer to the *Duke of Wellington*, for course of instruction, to date June 6th.

Russell, C. S., engineer to the *Pembroke*, for the *Porcupine*, to date April 11th.

Sadler, F., engineer to the *Duke of Wellington*, for course of instruction, to date June 6th.

Silk, E. S., engineer to the *Fembroke*, additional, to date May 19th, and to the *Endymion*, to date June 8th.

Stainton, G. H., engineer to the *Pembroke*, for the *Sturgeon*, to date May 19th.

Starkey, A. E., assistant engineer, to be engineer R.N.R.

Stevens, Charles, engineer to the *Renown*, to date May 19th.

Stevens, W. C., engineer to the *Pembroke*, for the *Bittern*, to date April 18th.

Stuart, J. J., fleet engineer to the *Endymion*, to date June 8th.

Vine, E. R., fleet engineer, has been placed on the Retired List, with permission to assume the rank of inspector of machinery.

Wallace, J., engineer R.N.R., to the *Duke of Wellington*, for course of instruction, to date June 6th.

Williams, R. J., engineer R.N.R., to the *Duke of Wellington*, for course of instruction, to date June 6th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE Fairfield Shipbuilding & Engineering Co., Govan, launched on the 12th ult. the *Kinfauns Castle*, a splendid mail steamer for the Castle Mail Packet Co.'s service to the Cape. The event attracted a very large concourse of spectators both inside and outside the yard, and the launching of the vessel was very successfully accomplished, the naming ceremony being performed by Lady Georgina Home-Drummond. The *Kinfauns Castle* is noteworthy as being the first twin-screw steamer built for the Castle Line, and is intended to be the fastest in Sir Donald Currie's Cape service. In the matter of dimensions she is one of the largest of Fairfield's productions, coming next in this respect to the famous Cunarders *Campania* and *Lucania*. She is 532 ft. in length, 59 ft. 3 in. beam, and 38 ft. 9 in. depth, moulded. Her gross tonnage is about 9,700 tons, and her engines are of 10,000 I.H.P. She will have accommodation for 800 passengers. A sister-ship, the *Kildonan Castle*, will be launched from Fairfield early in August.

The Fairfield Co. and the London & Glasgow Shipbuilding Co., Govan, have each received an order from the British Admiralty for a first-class armoured cruiser of 9,800 tons displacement, and with engine power sufficient to give the vessel a speed of 23 knots. With these two important orders the amount of naval work on hand in Clyde yards at present reaches to considerably over 100,000 tons.

Messrs. A. & J. Inglis, of Pointhouse Shipyard, have just launched a paddle steamer for passenger service on the Clyde, which in the matter of speed will, in all likelihood, exceed anything of her size afloat in the Clyde. This is the *Waverley*, for the North British Steam Packet Co., and the speed guaranteed is 18 knots. The *Waverley* is to be fitted with compound engines and the conventional "haystack" boiler.

The second of the Fairfield Co.'s smaller cruisers, H.M.S. *Highflyer*, went down the Clyde on the 15th of May, and on the following day got through her builders' trials in the Firth. In the afternoon she left for Devonport, from which dockyard her trials will be conducted shortly. Her sister-ship, the *Hermes*, will shortly begin her official trials in the Channel. The torpedo-boat-destroyer *Leven* got through her speed trials very successfully, and her survey has ended as satisfactorily. She will be clear for delivery in a few days.

Messrs. Wm Simons & Co., Limited, Renfrew, launched on 12th ult. a powerful steam-dredger, named *Pervi*, which is the first of two similar vessels being built by the firm for extensive dredging operations in connection with the improvement of Port Arthur and Talienwan. The vessel is capable of dredging and discharging 1,000 tons of soil per hour, and of working to a depth of 40 ft. below the water level. In addition to being provided with a chain of buckets for discharging into barges alongside, the vessel is fitted with a sand suction pump, also a mud discharging pump, to which is attached fully 2,000 ft. of shore discharging pipes, carried on floating pontoons, having flexible joints. Two pairs of compound surface-condensing engines are fitted for propelling the vessel at a speed of seven knots per hour. Electric light installation is provided for working day and night.

Messrs. Robert Duncan & Co., shipbuilders, Port-Glasgow, have received an order for a four-masted schooner, which will be constructed on somewhat similar lines to the *Honolulu* built in 1896 by the same firm for Mr. John Ena, of Honolulu. The new vessel will be of larger tonnage than the *Honolulu*, which was 1,073 tons, and—unlike that vessel, which had all her four masts of the same height and carrying fore-and-aft sails only—she will be square-rigged on the fore mast.

With reference to the order which, as stated in last month's note, Messrs. D. J. Dunlop & Co., Port-Glasgow, have secured from the Woermann Line, of Hamburg, for the construction of two passenger steamers of 6,000 tons each, it is reported that the contract would have been placed with German builders, but "the prices asked by the German firms invited to tender were higher than the Scottish firm's tender, besides which a much longer time was required to complete the boats."

The well-known firm of Messrs. Scott & Co., Greenock, has been formed into a joint-stock company, under the title of "Scott's Shipbuilding and Engineering Co., Limited," with a capital of £300,000 divided into 30,000 shares of £10 each. The businesses to be carried on are, as formerly, that of Scott & Co., shipbuilders and engineers, and the Greenock Foundry Co., engineers and ironfounders, East Stewart Street, Greenock. The signatories are: John Scott, R. Sinclair Scott, and Charles C. Scott, shipbuilders and engineers, Greenock; Jas. Henry Scott, merchant, London; Mrs. Annie Scott, Hawkhill, Largs; Colin W. Scott, merchant, 94, Hope Street, Glasgow.

From the boiler works of the Greenock Foundry Co., there lately emanated two unusually heavy marine boilers, which have been safely placed on board ship by the powerful crane at Victoria Harbour, Greenock. These boilers were of 90 tons each and were put on board the steamer *Calchas*, recently launched by Messrs. Scott & Co., for the Ocean Steamship Co., of Liverpool.

That the development of already established, and the opening up of fresh, fields of commercial enterprise, in various parts of the globe, are matters more and more on the increase is indicated by the demands being made on builders of light-draught craft for shipment abroad. On the Clyde several firms who almost wholly confine themselves to work of this class are exceptionally busy at present; and, as their vessels, after construction, are taken to pieces for shipment to their destination, building is proceeding on ground far removed from the usual riverside berths necessary when ships have to be launched into their native element. Messrs. Denny & Brothers, Dumbarton, who have for many years largely engaged in the building of light-draught craft for re-erection and service abroad, are finding it more and more necessary to utilise, for work of this kind, surplus ground belonging to them, lying outside their yard wall, but convenient and handy to one of the yard gates. They are now proceeding to erect, and equip with the necessary plant, a large fitting shed, 150 ft. long by 50 ft. broad, on the ground in question.

Messrs. C. Macdonald & Co., of Mair Street, Plantation, Glasgow, who build steam-launches and the lighter class of vessels, launched, on the 13th ult., the steam yacht *Una*—70 ft. long overall, 11 ft. 6 in. beam, and 7 ft. moulded depth. The noteworthy fact in connection with the launch of the vessel is that, notwithstanding her dimensions, she was built on Messrs. Macdonald's premises—a back yard, so to say—in Mair Street, Plantation, whence she was removed about 6 o'clock a.m., drawn down Govan Road by steam traction-engine, consigned to Prince's Dock, and had her engine and boiler on board before 9 a.m. The machinery has been supplied by Messrs. McKie & Baxter, of Copland Engine Works, Govan.

The work of sounding Glasgow Harbour for the purpose of ascertaining the various depths of water, which is done once in four years, is now in progress. The soundings, when finished, are formed into a chart of that portion of the river and estuary within the jurisdiction of the Trust, and this chart serves as a guide for dredging operations for the next few years. The 1891 soundings were accepted by the Admiralty as official, and still remain on their charts as such, the soundings below Newark Castle being those of the Clyde Lighthouses Trust, and those further down being taken by the Admiralty officials themselves. This year a beginning was made at the Victoria Bridge, and the boat's crew conducting the work have now reached Govan. The soundings in the upper reaches are taken at intervals of 20 ft. across, and 100 yards up and down the river, and in the lower reaches of 20 feet across and 200 yards up and down; more men and boats being employed as the work proceeds Firthwards. The operations require about four months to complete.

A well-known Clyde shipbuilder has invented a type of ship's watertight door and deckhouse window which, in respect of their construction and of the material of which they are made, mark a distinct advance on the kind of door and window frame *at present generally in use*. The feature of the door in question is the insertion, in a groove surrounding the opening, of a specially strong pneumatic tube, half the diameter of which projects from the framework and fits into a groove in the door or window. When the door is shut the tube is fully inflated by automatic action, and the joint is thus rendered absolutely air- and watertight. About 240 such doors and windows are at present being manufactured for the inventor, who will fit them on board a vessel at present under construction in his shipyard. The material of which these articles are being made also constitutes a distinguishing and highly important feature. This is a special metal, for which Mr. Lawson, manager of the new Howe Cycle Works, Glasgow, holds the patent, known as the "Rex" white metal. It is remarkably light, malleable, and requires no annealing after being cast. It is capable of brazing, and is white throughout, and will not corrode under any conditions. In price it compares favourably with gun-metal. As regards weight the 240 doors and windows now being made weigh in the aggregate 14,160 lbs. less than would the same articles made of cast iron, and they will serve the purposes required of such doors and windows much better.

Messrs. Ramage & Ferguson, shipbuilders and engineers, Leith, have contracted to build a screw steam tug to the order of Sir Donald Currie for service at the Cape. Messrs. Hawthorn & Co., of the same port, have received an order to build and engine a steam trawler of about 300 tons for the Royal National Mission to Deep Sea Fishermen. The vessel, which will have triple-expansion engines capable of driving her 12 knots, will be fitted up as a hospital, provision being made for the accommodation of a missionary and a surgeon.

The Leith Dock Commissioners have placed an order with Messrs. W. & T. Averey, Limited, for a set of five automatic grain-weighing machines, by means of which the grain discharging and receiving facilities of the port will be much enhanced. The set of machines just ordered, which are similar in every way to those at present extensively in use at the London docks, will be capable of automatically filling, weighing, and registering 20 bags of grain in one minute.

According to Mr. F. W. Paul, late manager of the Blochairn Works of the Company of Scotland—who has left that company's service to occupy the position of general manager of the Shelton Iron and Steel Co., Limited, Stoke-on-Trent, and who early in the month was entertained to dinner in Glasgow, and presented with substantial tokens of the esteem in which he is held—the competition this country is meeting with from America in connection with the steel trade is not to be underrated. We had heard so much about this matter of late, and had at the same time been enjoying such prosperous trade conditions, that we had almost come to believe that the cry contained but little foundation in fact. It was the fact, however, that during the last 12 months some 10,000 to 12,000 tons of shipbuilding material has actually been landed in the Clyde district and at Belfast from America at prices which home manufacturers would not accept. Moreover, an order had recently been placed in America for 30,000 tons of steel for Australia. To meet this competition, he suggested that the railway companies should recognise the duty that devolved upon them to take their part in the international struggle for commercial supremacy, and by carrying goods at lower rates assist the industries of this country in maintaining, if not enhancing, their present condition. Pig-iron manufacturers also should seriously consider what could be done to lessen the cost of the raw material to the steel manufacturer.

During the past four years the representative of the Glasgow Chamber of Commerce and Merchants' House on the committee of Lloyd's Registry has been Mr. Ross, of Messrs. Ker, Bolton & Co. Mr. Ross, having intimated his desire to retire, Mr. Henry Bell, of Messrs. Bell, Brothers & McLelland, has been appointed representative in his stead. At the meeting of the Chamber of Commerce, at which the appointment was made, the president intimated that a communication had been received from the Clyde Steamship Owners' Association stating that at a meeting of directors the whole position of the representation of the Clyde district on Lloyd's was discussed, and there was a unanimous feeling that the present representation was inadequate. It was felt that the importance of the district as a shipowning, shipbuilding, and an underwriting centre entitled it to at least equal representation with Liverpool, and that the time had come to approach Lloyd's Committee on the subject with the view to a local branch being formed. They asked the Chamber to appoint representatives to a meeting to be held, when the matter would be considered. Mr. W. F. G. Anderson pointed out that this had long been a standing grievance in the Clyde district, and it was largely on account of this that the British Corporation had been formed. That corporation had been an entire success, and had given satisfaction to every one connected with it. Mr. J. A. Duncan urged the importance of more representation on Lloyd's Committee. Representatives were appointed to attend the meeting convened by the Steamship Owners' Association.

THE TYNE.

(*From our own Correspondent.*)

Shipbuilding.—So far as concerns the ordering of new tonnage, business in this district continues in quite a stagnant condition, and if this continues, the yards—though still quite full of work— must in the course of a few months begin to show symptoms of slackness. The fact that the quantity of floating tonnage in existence is somewhat in excess of the demand is shown by the continued depression in freights; and the addition, to an already overstocked market, of the vast amount of tonnage now approaching completion in our yards will not tend to render less discouraging the prospect for the shipowner. During April and the greater part of May the weather has been exceedingly unfavourable for outdoor work, and much time was lost by the platers, riveters, and other outdoor workers in consequence. This would, perhaps, not have been so severely felt, if the men had not already lost a good deal of time when there was nothing to prevent them from working; but the two circumstances, of wilful abstention from work in the first place, and compulsory abstention in the second, have so far altered the outlook that it is now universally felt that last year's output cannot be equalled, or even approached, in the current year. The officials of the Boilermakers and Ironship Builders' Society, however, take a hopeful view of the future, as may be seen by the report (May, 1899) from the chairman, secretary, and "delegate" of the Tyne District Committee, which says, "There is, as yet, no falling off in briskness, for as soon as launches take place the berths have been immediately cleared for the laying-down of other keels, and the whole of the available space for shipbuilding in the various yards on the river continues to be fully occupied. At a number of our shipyards spare ground is being taken in, and extensions on a large scale are being pushed ahead with the view of providing room for the building of much larger vessels than have hitherto been constructed on the Tyne. New and heavy machinery is also being put down, and, when the arrangements are fully completed, the local employers will be in a position to compete for the building of all classes of vessels without any restrictions as to size, speed, or equipment."

Messrs. Armstrong, Whitworth & Co. have made an application to the Tyne Commissioners, having reference to the driving of piles in the river foreshore, for the purpose of lengthening the building berths, and it has been decided that a deputation from the latter body shall visit the yard on an early date to examine and report upon the matter. It is quite certain that what Messrs. Armstrong, Whitworth & Co. are asking for is bound to benefit the district, being merely a question of development, and it may be taken for granted that the Commissioners will place no unnecessary obstacles in the way of local enterprise.

Messrs. Wigham, Richardson & Co. have a large boat in course of construction for a German company of high standing, and have several other contracts of an exceptionally important kind to go on with. There are vessels in the water undergoing repairs or final equipment for sea, and in all the departments a condition of high-pressure activity is maintained. Messrs. Wood, Skinner & Co., have their berths fully occupied with cargo boats, and at Messrs. Dobson's yard a similar state of things exists.

It is understood that the site—several acres in extent—which was formerly occupied by the Walker Ironworks, and which is situated a little to the westward of Messrs. Armstrong, Whitworth & Co.'s Low Walker yard, has passed into new hands, and will soon be utilised in connection with the initiation of an important industrial enterprise. The exact nature of the undertaking has not yet transpired, but it is believed in the neighbourhood that it is something in some way associated with the fitting out of ships. Two blast furnaces are still standing in the place, but they are of a somewhat antiquated type, and would scarcely be of much use under modern conditions of production. The rolling mills were dismantled, however, long ago, and under these circumstances the presumption may be hazarded that the manufacture of steel or iron forms no part of the project in the minds of the new proprietors. Whatever the exact nature of the enterprise may be, however, there is no doubt that it will have exceptional chances of success, as the situation of the site is about the best in the district, affording quick access to both rail and river, and being in close proximity to some of the largest shipbuilding and engineering works in the north.

Messrs. Hawthorn, Leslie & Co. are actively engaged in preparing for the laying down of the three torpedo-destroyers ordered by the Admiralty, and they are also very busy with mercantile work. It is strongly hoped that the volunteer boat, which is now supposed to be in the market, will be placed with this firm, who have built so many splendid vessels for the well-known Russian syndicate.

One of the vessels now on the stocks at Messrs. C. S. Swan & Hunter's yard is said to be the largest at present building in the British Isles, being considerably over 600 ft. long, and of proportionate dimensions in other respects. This vessel is understood to be for the Cunard Co., and is to be fitted out in a unique style. During the exceptionally wet weather that has lately prevailed, the utility of the covered berths at this establishment was abundantly demonstrated, work having been but little interrupted on the vessels building in these sheltered positions, while in connection with the constructive operations on vessels not so protected a good deal of time was unavoidably lost. Should the firm decide on covering in the whole of the berths in their yards, it may come to pass that—in this case at all events—shipbuilding and pontoon building, may be carried on with as little interruption as engine building. It is not yet known whether the firm have any such intention; but, in view of the great results that have followed their previous bold advances in development, it is by no means out of the range of probability that they will carry to its legitimate conclusion the important principle they have as yet but partially applied.

The Palmer Shipbuilding & Iron Co. have put off the stocks several exceptionally large vessels this year, and have one or two others almost ready for launching. Some disappointment has been felt in the district through the company's tender for one of the cruisers recently ordered by the Admiralty not having been successful; and even the acquisition by the company of three torpedo-destroyers has not dispelled, or even greatly lessened, the popular dissatisfaction. The fact is that the Jarrow people are (with good reason) proud of their yard, and naturally think that, when the larger class of the country's battleships are given out to private builders, one at least of them ought to find its way to the well tried and amply equipped establishment which is to Jarrow what the great Elswick establishment is to Newcastle.

The Tyne Shipbuilding Co. have their three berths occupied, the vessels on the stocks being in the various stages of framing, plating, and preparing for launching. In the initiatory departments work is exceedingly busy, and it is believed that there are orders enough on the books to keep the place busy for at least another twelvemonth.

Messrs. Readhead's yard continues to maintain an appearance of great briskness, the four vessels on the stocks being of large size, while others of equal dimensions are in preparation. At the small yards between Tyne Dock and the river entrance, the berths are well filled with fishing vessels, and the graving docks within the same area are fully occupied with vessels, undergoing painting or repairs. A rumour is current, which appears to be well founded, that a site has been secured at North Shields, on which a newly formed company are about to erect premises to be adapted to the building of ships and engines of a small class. Repair-work will probably also be undertaken, and it is stated that a machinery equipment, of a very complete and elaborate kind, will be provided. There seems to be abundant scope for an establishment of this kind, as the demand for fishing vessels and other small craft has been well sustained for some years past, and is at present so good as to severely tax the existing sources of supply.

Engineering.—There is not, at the moment, any sign of the demand for an advance of wages put forward some time ago by the engineers being persisted in, and it is therefore probable that the steady work now going on in the factories will meet with no interruption during the next few months. The abandonment of this wages claim, simply because the employers declined to grant it, is an incident of the greatest significance, and is quite a new departure for the engineers, or any other great body of trade-unionists, to make. For many years it has been part of the gospel of trade-unionism never to recede from a position once deliberately taken up without first trying the chances of battle. In other words, they were not particularly given to the uncongenial task of "eating the leek." The upshot of the struggle over the hours question in 1897 has, however, taught the engineers to shape their policy differently, and to place their standard of "honour" on a somewhat lower height. They have apparently been impressed with the lesson that it is folly to persevere in a course which is sure to end in disaster, and they could hardly fail to see that any attempt to enforce the demand referred to must have inevitably ended that way. It is to be hoped that under similar circumstances, should such arise in the future, other bodies will be guided by similar considerations, and not allow themselves to be dragged into ruinous disputes by the mistaken notion that it is dishonourable to "retract." The wisest of men may sometimes make mistakes, and it is no dishonour to admit a mistake or to abandon a position which is found to be untenable.

At the Wallsend Slipway Works there are a number of important repair contracts being carried out, and the new work in hand is considerably above the average. The St. Peter's Engine Works continue to be busy in all departments, and the works of Messrs. T. Toward & Co., in the same locality, have as many orders in côurse of execution as are sufficient to keep the machinery fully going, and a full staff of hands employed. At the works of Messrs. R. Stephenson & Co., South Street, Newcastle, both the marine and locomotive departments are busy, the latter particularly so, and in the oil-engine department a considerable pressure of work exists.

The Elswick Ordnance Works still show a high state of activity throughout, and it is just announced that a large order for guns for the Royal Navy has been received from the Admiralty.

The new forge which is being erected by Messrs. H. Fownes & Co., on a convenient site in the vicinity of Tyne Dock, is rapidly approaching completion, and the machinery equipment —which is to be of the most effective description—is also being actively carried out. Productive work will be commenced at a very early date, and we understand that the firm have already booked a large number of orders. The engine and ship repairing works of Messrs. C. R Toomer & Co., Limited, Tyne Dock, are, and have been for some time past, very busy, the special facilities which the firm possess for the prompt execution of contracts being much appreciated by shipowners.

At the works of Messrs. Newton & Nicholson. in which the manufacture of Taylor's patent corrugated metallic packing for joints is the speciality, business is exceedingly brisk, and is likely to continue so for a long time to come. The strain upon the firm's resources, to keep pace with the demand for this packing, has been so great that extensions had become imperatively necessary, and since the opening of the works some few years ago they have been more than quadruple in extent.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—Among recent announcements of interest to shipping communities is one to the effect that Messrs. Short Brothers, of the well-known shipbuilding works at Pallion, have secured at Seaham Harbour sites for a new shipyard and engine works, and a graving dock capable of accommodating the largest vessels that are likely to enter the port under the improved *regime* that is about to be established. In connection with this firm's yard at Pallion, there is a rumour afloat that the officials of the Boilermakers' Society are trying to get it under their control. We do not disguise the hope that this may turn out untrue, for the yard under present arrangements is a standing illustration of the fact that shipbuilding can be carried on independently of the Boilermakers' Society, and that a business conducted on such conditions may even attain exceptional success.

The tonnage launched in April, 1899, shows a distinct falling-off when compared with April, 1898, the amount for the former period being 11,000 tons, and for the latter 28,000 tons. Luckily this does not indicate a corresponding falling-off in the volume of trade, and the disparity is doubtless due to the circumstance that this year an unusual prevalence of wet weather interfered with the finishing of vessels, and consequently kept them on the stocks longer than was expected.

The electrical machinery at Sir James Laing's new yard is now in full operation, and is found to be a marked improvement on the steam-driven plant. The firm have six large vessels on the stocks, and an oil-ship undergoing an extensive overhaul in the Cornhill Dock. Messrs. R. Thompson & Sons have also a large repair contract in hand, in addition to the new work, which is considerable. The state of business at the North Sands Yard (Messrs. J. L. Thompson & Sons') is still all that could be desired, the berths being fully occupied, and there being plenty of movement in the preparatory departments. The special facilities for carrying out repair work, which the firm have provided at their Manor's Quay Works, have been very fully utilised during the whole of the present year, and a good many contracts have been dealt with in the time. A number of new vessels have also been equipped here, and the mooring place beside the wharf is seldom untenanted.

The two yards at the South Dock—Messrs. Bartram's and the Sunderland Shipbuilding Co.'s—are still well provided with work, and at Messrs. Austin's establishment the pressure is quite exceptional. The yard of the Strand Shipbuilding Co. is also very busy, repair contracts forming a very considerable proportion of the work in hand. Builders of ships' boats are fairly well off for orders, and the operatives connected with this branch are fully employed.

Engineering.—Full activity continues to be maintained at all the marine engine works, and in every case vessels are being fitted at the wharves with their machinery. The Palmers' Hill Works are, perhaps, the busiest, the contracts in hand being both numerous and important. The firm are just now re-boilering an old steamer, and have ordered two Deighton's patent corrugated furnaces for the job. Orders for Dickinson's patent crank shaft continue plentiful, and in this, as well as in other departments of the works, special means for accelerating production have had to be adopted.

Messrs. Forster & Sons have opened a new forge at Pallion, in close proximity to the building where, for many years past, they have manufactured a well-known type of stockless anchor. The new forge is intended specially for the forging of stern-frames, rudders, engine shafting, &c., and, as it is being started at a time when the demand for this class of forgings is exceptionally brisk, the prospect of success appears to be good.

The Monkwearmouth Ironworks are kept very busy, the demand for the company's special sections being more than ordinarily good. At the Monk Street Foundry business is as brisk as possible, and most of the other foundries in the district are pressed with work. Brass and copper works are also quite busy, the equipment of new ships absorbing a large part of the product of these establishments.

The new works started by Mr. Richard Lynn at Pallion some little time ago (known as the Westmoor Engine Works) are having a fair measure of prosperity, and the area of production has been enlarged.

The Hartlepools.—The yards of Messrs. W. Gray & Co. are fully supplied with work, most of the vessels on the stocks being of large dimensions. There is also a quantity of repair work in hand, and at the Central Marine Works vessels are being fitted out for sea Messrs. Furness, Withy & Co.'s yard is extremely well employed, and the same may be said respecting Messrs. Irvine's.

Messrs. Richardson's engine works are as busy as could be wished, and quite lately have had a large vessel from the Wear to fit with her machinery. The demand for Morison's evaporator (which is manufactured by the firm) continues to grow, and a further extension of the premises, specially laid out for its manufacture, will probably become necessary. The Hartlepool Steel Works are in full swing, local shipbuilders and boilermakers requiring most of the product, and in the docks business is beginning to show improvement.

Stockton.—At this centre the state of affairs in shipbuilding has shown little change since the advent of 1899, work being plentiful at all the yards, but its progress being impeded by unfavourable weather. Marine engine works are still very actively employed, and other engineering establishments show no lack of orders. Boiler and bridge works are kept briskly going, and at the various steelworks it is found necessary to work all the time possible to keep pace with customers' requirements.

Middlesbro'.—The yard of Sir Raylton Dixon & Co. continues to show the appearance of full activity that has for an exceptionally long period distinguished it, and at Messrs. Craggs & Sons' yard similar evidences of prosperity are presented. Engineering works at this centre show undiminished briskness, and the same may be said of steelworks, boiler works, forges, foundries, &c. In the docks more animation is to be witnessed, the season for timber importation having now practically commenced.

Darlington.—The works of the Darlington Forge Co. are still extremely busy, many of the contracts in hand being of an exceptionally important kind. Other industrial establishments in the locality are doing well.

THE MERSEY.

(*From our own Correspondent.*)

THE exceptional activity which has been reported for some time past throughout all branches of the engineering trades of this district is beginning to show in some directions a tendency to slacken off. This is noticeable chiefly amongst the builders of heavy stationary engines, who here and there are not receiving quite as much new work as old orders run out, whilst in the textile machine making industries there is also a decided quietening down. So far the undoubted lessening activity in the chief shipbuilding centres has not appreciably affected the important machine tool making branch of industry, all the leading firms being still exceedingly busy, many of them having a large amount of marine engineering work in hand, but the effect of any quietude in the shipyards will, of necessity, before long be felt here. There is, however, no probability of any shortness of work amongst machine-tool makers in this district over the remainder of the present year, and in many cases well into next, most firms reporting that they are still getting new orders in, quite equal quantity to those running out—in fact, in many instances, more than they are able to entertain, except for long-deferred delivery. The boiler-making trade in all sections continues extremely busy; locomotive builders are also greatly pressed with work, and the principal firms are not in a position to book orders for some time to come. All branches of electrical engineering are exceedingly well engaged, owing to enormous developments going on in various directions, and hydraulic engineers are in much the same position.

The monthly returns of the leading trade unions show a continued low unemployed list. In the Steam Engine Makers' Society there is only about one per cent of the total membership on donation benefit, whilst throughout the Lancashire district practically a "clear book" is reported. As to the state of trade, some of the marine centres report a slackening off, but this has no appreciable influence on the unemployed list. The United Machine Workers' Association has 2½ per cent. of the total membership on benefit, but locally there are only 1½ per cent. on the books, and at Beswick, Belfast, Hartlepools, Glasgow, Bradford, Doncaster, Huddersfield, Halifax, Blackburn, Ashton, Lancaster, Crewe, Gloucester, Wigan, Edinburgh, Woolwich, Erith, Hammersmith, Hyde, Westwood and Grimsby, there are no out-of-work members. Out of 47 reports as to trade, 27 describe it as "good," and the remainder as "fair."

The annual reports of the Amalgamated Society of Enginers', and the United Machine Workers' Society have during the past month been issued to the members. The Amalgamated Society of Engineers commenced the year 1898 with 91,444 members, and ended it with 83,564—a decrease of 7,880. The income for the year was £450,727, which, added to the balance of £174,852 from the previous year, made a total of £625,579. The expenditure was £417,457, having a balance of £208,121. This showed a saving on the year of £33,269, besides which the amount of the society's indebtedness in December, 1897—£22,900—had been cleared off. The chief item of expenditure was the donation benefit, which cost £120,874; superannuation amounted to £74,688; contingent £52,725; sick benefit £42,573; emergency and local levy grants £33,737; funerals £13,402; benevolent grants £2,784; accident benefit £2,643; and organisers' or local, delegates' salaries and expenses £[illegible],309. In addition to this there were loans repaid, amounting to £45,311. The United Machine Workers' Association started the year with 3,876 members, and closed with 3,440, a loss of 436, no less than 209 of the excluded members having been connected with the Oldham district. The income for the year was £11,811, which, added to a balance of £823, gave a total of £12,635. The society paid £5,813 unemployed benefit; £1,047 sick benefit; £134 superannuation benefit; £214 funeral benefit; a total of £7,209 for four benefits, as compared with £32,156 the previous year. The balance in hand increased from £823 to £1,316, a gain of £493 on the year's working. It may be added that both the Amalgamated Society of Engineers' and the United Machine Workers' Society have definitely joined the new general federation of trades.

There is very little that is really new to report in connection with the Mersey shipyards. The only matter of interest to record is that the torpedo-boat destroyer H.M.S. *Orwell*, built by Messrs. Laird Brothers, completed her official trial on the Clyde on the 2nd May, in the presence of the Admiralty representatives, the results obtained being very satisfactory. The mean speed of the six runs on the measured mile was 30·8 knots, the speed for the three hours' continuous steaming being 30·2 knots. The details of the miles are as follow:—Time 1 min. 57·6 sec., speed 30·6 knots, steam 220; time 1 min. 57·8 sec.; speed 30·55 knots, steam 220; time 1 min. 57·2 sec., speed 30·72 knots, steam 225; time 1 min. 56·4 sec., speed 30·93 knots, steam 225; time 1 min. 57·8 sec., speed 30·56 knots, steam 225; time 1 min. 56·8 sec., speed 30·82 knots, steam 225. After completing the speed trial the vessel successfully carried out her steering trials, ahead and astern, at full speed.

The Atlas Engineering Co., of Levenshulme, Manchester, are introducing several improvements in machine tools. Amongst these is a special wheel-cutting machine for wheels up to 10 ft. and 12 ft. diameter, and 4 in. pitch. One of the chief features of this new design is an arrangement for dividing automatically by means of a notched wheel, which takes the place of division by hand. A latch fits the notch, and is automatically withdrawn, which has the effect of turning a coarse-threaded screw, which screws up the friction wheel actuating the dividing mechanism. The notched wheel, having only one notch, cannot divide inaccurately, as the latch cannot go in before one revolution has been completed. An ingenious arrangement has also been introduced in the driving gear for planing machines, which is adaptable to the angle of belts without the intervention of the ordinary clumsy forged strap forks. This arrangement consists of a square-frame bracket, adjustable about the centre of the driving shaft. This bracket, in addition to supporting the shaft, carries the belt forks, which are actuated by a new trip motion that shifts one belt before the other operates. It may be added that the firm have just completed a considerable extension of their works, a special feature of their large new machine shaft being that all the plant with which it is equipped consists of tools of their own manufacture.

The iron trade here has fully maintained the strong tone reported last month, and there has been a further very considerable advance in prices. Buying has been mostly confined to small quantities for pressing needs, but makers and manufacturers are mostly well sold, and consequently in a position to be indifferent about further business for the present. Local and district makers have little or nothing to offer, and their prices have gone up fully 3s. to 4s. per ton, foundry qualities being quoted about 61s. 6d. to 62s. less 2½ for Lancashire; 58s. 6d. to 59s. 6d. net for Lincolnshire, and about 60s. to 61s. for Derbyshire, delivered Manchester; whilst forged qualities are not quoted under 58s. 6d. to 59s. less 2½ for Lancashire, and 57s. 2d. to 58s. 2d. net cash for Lincolnshire, delivered Warrington. Outside brands are 4s. to 5s. higher, with orders difficult to place for any quantity; good foundry Middlesbrough is now quoted 64s. 4d. net by rail Manchester, with Glengarnock and Eglinton about 67s. 6d. to 68s. net cash, delivered Manchester Docks, and lots of American iron have been sold at 61s. 6d. net.

In the finished iron trade there is less pressure of orders, but the enquiry is quite sufficient for makers in the present state of their order books. Lancashire bar makers have put up their list basis to £7 5s., and North Staffordshire qualities have been officially raised to £7 10s., delivered in this district. Sheets are also higher, £8 5s. to £8 7s. 6d. being now the average. Association list rates for hoops have been advanced 7s. 6d. per ton, and are now £7 12s. 6d. for random, to £7 17s. 6d. for special cut lengths, delivered Manchester district, and 2s. 6d. less for shipment.

In the steel trade prices, which last month showed some irregularity, are again tending to harden. The exceptional activity in various departments for structural work is bringing forward a large demand for material, which seems to be replacing any falling off in requirements for shipbuilding. Ordinary foundry hematites are not now quoted under 72s. to 73s. 6d. less 2½; billets £5 5s. to £5 7s. 6d. net cash; angles £7 5s. to £7 7s. 6d.; bars, £7 15s. to £7 17s. 6d.; common plates, £7 17s. 6d. to £8; and boiler plates, £8 12s. 6d. to £8 15s. delivered in this district.

The metal market maintains a brisk tone, and prices continue on the upward move, list rates for brazed and seamless copper tubes having been put up ½d. and seamless brass tubes ¼d. per lb. delivered Manchester district. List rates are now as under:—Solid-drawn brass boiler tubes, 9d.; solid-drawn brass surface condenser tubes, 10½d.; solid-drawn copper tubes, 11¼d.; brazed copper gas and steam tubes, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d.; common brass wire, 8½d.; copper wire, 10¼d. per lb.

Little change can be reported in the condition of the timber trade, arrivals having been moderate with deliveries generally fairly satisfactory, stocks mostly light and values steady. Teak squares have arrived in small quantity, and there is a steady demand, with stocks not heavy. Prices have improved, but not to the same extent as for planks. The import of planks has been fairly large, but the demand continues good, at steady rates, and stocks are not excessive. Two cargoes of greenheart have come in, and the stock is heavy.

A leading Liverpool firm of timber and mahogany brokers in their monthly circular make some complaint respecting action recently taken by the Mersey Docks and Harbour Board. "The Board," they state, "have given notice to a number of their tenants at the Canada Dock to quit the premises they hold, thus still further reducing the already limited and totally inadequate accommodation the timber trade possess for conducting their business, and which must entail a very serious disturbance and loss to an important business, which employs upwards of half a million tons of shipping during the year; some 300,000 tons per annum have already been diverted to neighbouring ports, chiefly to Manchester, and the present action of the Mersey Docks and Harbour Board will tend to drive still more of the trade in that direction, and thus make Manchester the chief distributing centre of the timber trade instead of Liverpool."

The coal trade here shows no material change. Pits continue on full time, and the output is moving away with prices firm at late rates. House-fire qualities continue in exceptionally good demand for the time of the year, and there is still none of that accumulation of stocks that usually takes place, whilst prices are well maintained at the full list. Steam and forge coals are in active request, with supplies barely equal to the demand, and good qualities readily fetching about 9s. at the pit. Gas coal contracts are being settled on the basis of about 9s. for the commoner sorts, and 9s. 6d. up to 10s. for the better qualities at the pit's mouth. Engine fuel is rather more plentiful in the open market, increased quantities coming in from Derbyshire and Yorkshire, but Lancashire collieries are generally short of supplies, and their prices are very firm at 6s. 6d. to 6s. 9d. for best; 5s. 9d. to 6s. for medium, and 5s. 3d. to 5s. 6d. common sorts at the pit's mouth.

Shipping is only moderate, with ordinary steam coal averaging about 9s. 6d. Garston Docks; 10s. High Level, Liverpool, up to 10s. 6d. on the Manchester Ship Canal.

THAMES.

(*From our own Correspondent.*)

MESSRS. W. H. ALLEN, SON & CO., of Bedford, have lately constructed one of the largest self-contained surface condensing plants yet made in the United Kingdom. It has a tube surface of 2,000 lbs. of steam per hour with a vacuum varying between 27 in. and 28 in. The shell and frame is of cast iron, and the tube plates are of rolled naval brass and tubes of solid-drawn brass. The tubes are fixed into the plates with screwed ferrules and tape packing. The condensing water passes into the condenser at the bottom and out through the top. The air and circulating pump-engine is inverted with 10 in. by 17 in. diameter cylinders and 14 in. stroke. Two fly-wheels are fitted to the crank shaft. There is a double acting circulating pump with a diameter of 19 in. and 14 in. stroke. The speed of the engine when the pump is working at its full capacity is 60 revolutions. The weight of the whole is 390 cwt.

Messrs. John Steward and R. & H. Green, who build so many steel barges, should have a fair opportunity of some of the twelve steel barges for which the Belfast Harbour Commissioners are inviting tenders. They are designed to carry twenty boxes 6 ft. 6 in. long, 4 ft. wide, and 4 ft. 9 in. deep. The material is to be Siemens-Martin mild steel, to be suitable in quality and tests to Lloyd's requirements. The contractor has to keep them in repair for three months after completion. Preference will be given to the contractor who undertakes to deliver the barges within the shortest date after acceptance of tender.

Very many of the engineering firms on the Thames are at present turning out some of their old cutting tools and replacing them with American or those with the latest improvements in this country. It will be satisfactory for some of those to know that Messrs. Schischkar & Co., of Birmingham, have just put on the market a very excellent capstan lathe. It has a four-speeded cone 8 in., 10 in., 12 in., 14 in. in diameter by 3½ in. face. The spindle has parallel necks in long gun-metal bushes. There is a self-centreing clinch with jaws to carry from 1¾ in. to 1 in. diameter iron and a hole through the spindle to admit of any length of iron. The bed is 6 ft. long, 12¼ in. wide across the face. It is fitted with a saddle or carriage 3 ft. long. The revolving table is 16 in. diameter, fitted with four tool holders. It is revolved by hand.

Messrs. A. & J. Thompson, of Custom House, have a very good arrangement of steam whistle which they are fitting in many steamers. In most steam whistles there is a long pipe from the boiler to the whistle, and in the ordinary arrangement this pipe often gets filled with water. The consequence is that the signal is by no means instantaneous; in fact, a considerable time elapses between the pulling of the whistle cord and the sound of the whistle. It is of the utmost importance that an immediate and clear sound from the whistles and sirens of steam vessels should be obtained. Moller's drainage valve is designed to obviate these defects. It will be seen that in this type of drainage valve the passage on the right side, which is the passage from the boiler, is closed by a valve, but the upper passage to the whistle is always open to the left lower drainage passage, and there can thus be no accumulation of water in the whistle pipe. The instantaneous, clear, and full sounding of the whistle is thus rendered an absolute certainty. To obtain this certainty is of great importance, as the safety of the vessel is in many cases dependent on the means of prompt signalling. The North German Lloyd Co. have had them fitted to their fleet, and many vessels in the German Navy have also been fitted with them.

Messrs. Caird & Raynor are very full of work at the present time with heaters, evaporators, and condensers. Lately they made an excellent steriliser for the purifying of water.

BELFAST.

(*From our own Correspondent.*)

THE past month has been exceptionally quiet here in regard to shipbuilding and engineering, inasmuch as there is not a single launch from any of the yards, nor even a trial trip to report. As we said last month, the extensive repairs and alterations to so many large vessels have evidently arrested the progress of new work; besides, the limited number of hands of a certain class obtainable, coupled with the slow delivery of material, combines to obstruct the output of new work, which is to be much regretted.

Work on board the s.s. *Oceanic* is going on apace, her masts and funnels being now almost complete. These enormous funnels are the subject of general remark. Owing to their extreme height, two of the top courses of plating have had to be built on their place in sections, as the crane could not reach them. We understand the height of these funnels, from top of furnace-grate bars to top of funnel, is 120 ft., which should enable the smoke to be carried well clear of any part of the steamer's deck. Every kind of work on board is being hurried on as fast as possible, so that by another month she should be fairly well advanced towards completion.

The s.s. *Germanic* is now being finished up after undergoing a most extensive overhaul, and with her fresh coat of paint and new fittings will almost look like a new vessel; but she does look small and insignificant when lying alongside her sister ships, the *Medic* and *Afric*, her funnels being scarcely seen over the deck houses of these two leviathan steamers, which still lie in Abercorn Basin. The *Medic*, however, is getting well on towards completion, whilst the *Afric* has returned for refrigerating machines and some other alterations, which are well advanced; and it is expected these two vessels will be on their old stations before long.

The P. & O. s.s. *China* has not yet gone into graving dock, but a great many hands are employed on her, making preparations for her occupation of the graving dock. Her repairs will take months to execute.

The new s.s. *Winifredian* still lies in Abercorn Basin, and there seems to be a great scarcity of men to carry out the work required on her. As already mentioned, Messrs. Harland & Wolff, Limited, who have all these repairs on hand, find it very difficult to procure sufficient men for their requirements, although at the present time they have in their employment upwards of 9,000 men; but certainly, unless more progress is made with the new work in hand, the output at end of year will be curtailed very much.

Messrs. Workman, Clark & Co., Limited, have still the s.s. *Ping Suez* in hand, but she is nearly finished. They have also the s.s. *Brisgravia*, for the Hamburg-American Co., almost completed. She will leave here in the course of a week or ten days. This firm (Messrs. Workman, Clark & Co., Limited), have also had a large number of ship and engine repairs recently, so much so that they are at present making extensive additions to their repairing works at Abercorn Basin, in order to meet their requirements in this department, and we understand that when these extensions are completed they intend making all their own winches, windlass and steering gear for their steamers, which will mean employment for more men. This firm are also very much hampered for want of ironworkers in their building yard, but they have several vessels in a forward state for launching, and we hope to report some of these next month.

Messrs. MacColl & Co., Limited, are at present building a ferry-boat for the Belfast Harbour Commissioners, and they are also constructing cranes, &c., for use at the harbour. A deputation from the Belfast Harbour Board have again gone to London to seek the assistance of Government in making a suitable new dry dock, which would accommodate war vessels as well as these large liners, but so far their mission has met with little success. This question of dry dock accommodation will have to be faced at once, as the increasing wants of this port demand it, and surely there is enough money and energy to enable us to get it at no distant date. We might state that piling has commenced for the extension of the harbour on the south side of the river, and when part of this is done, so that the dredger can work, there will soon be a flotilla of barges, cranes, &c., at work. A great many of the new electric light poles, which are of malleable iron tube, are now completed. These look very neat with lamp on top, and when all are lighted will be a great advantage to the district on both sides of the river.

All the foundries and smaller engine works here keep well employed, consequently very few men who care to work are idle.

The Londonderry Shipbuilding Yard have commenced operations, and have got the keel of their first steamer laid. This vessel is being built to the order of Messrs. McVicker, Marshall & Co., of Liverpool, who are extensive shipowners, and has a dead weight of 6,200 tons, and measures 375 ft. over all, but they are now face to face with their first strike of labourers, who have demanded an increase of wages from 16s. to 20s. per week (not a bad rise if they can obtain it), but as there is plenty of unskilled labour in and around this district, we anticipate this strike will be of short duration.

The paddle steamer *Slieve Donard*, which belonged to the Belfast and County Down Railway, and ran to Bangor and other holiday resorts along this coast, left this port during the month, having been sold to Bristol owners. It is reported that Messrs. G. & J. Burns intend running a passenger service direct from Glasgow to Bangor, Co. Down, which will increase the popularity of this growing suburb and be a splendid sea trip for excursionists at a cheap fare.

Messrs. Ramage & Ferguson, Limited, Leith, have received an order to build a Twin-screw steamer for South Africa, and also for a cargo steamer to carry 1,900 tons deadweight.

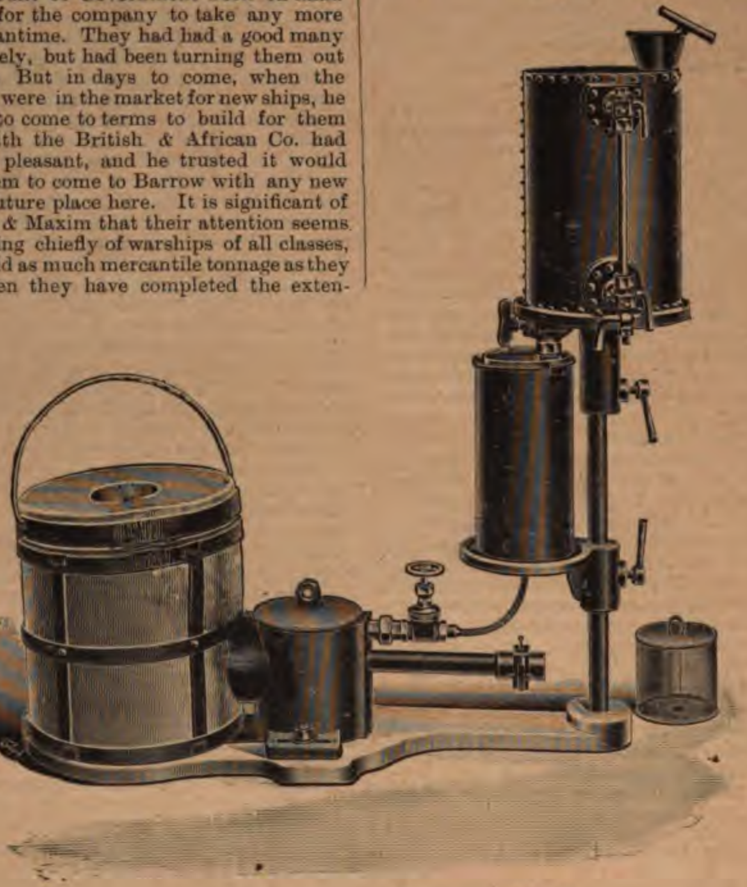
NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—There is great briskness and life in the shipbuilding and marine engineering trades of Barrow. No new orders have been booked during the month, but very little need for them exists, seeing the very large orders already held. Yet more of the same sort will be welcomed and are expected, but in the meantime the works are being gradually enlarged, and being fitted up with the newest and most modern appliances; electricity is taking the place of steam-engines for motive power, and a general expansion is taking place at the works of Vickers, Sons, & Maxim, with the view not only of making the naval construction works more complete, but of embracing within its operations many new departments that will make the concern more and more dependent on its own resources in a great variety of ways. One of the most important developments taking place at present is one for the manufacture of gun mountings. This, when complete, will be nearly as large a department as that of marine engineering itself, and it certainly is a department which is exceedingly busy and has orders before it which will ensure very great activity for a very long period of time to come. Preparations are being made for the launch of H.M.S. *Vengeance* on July 25th. This will be a red-letter day in Barrow, as it will not only be the first battleship ever built at Barrow, but will be the first battleship ever built and fully equipped by one firm. The launch of the Pacific liner *Ortona* will very possibly take place before that of the *Vengeance*, as her owners have need of her, and the greatest possible progress is being made with her construction. She is plated, and the riveters are very busy with her, while the engineers are at work in the bringing out of her stern tubes. The *Euryalus*, first-class cruiser, will go down on the berth vacated by the *Ortona*, and the *King Alfred*, first-class cruiser, will go down on the berth now occupied by the *Vengeance*. The *Hogue*, first-class cruiser is well in frame, and the Japanese warship, which is a monster, having a very great beam and bearing frames, is gradually assuming shape. By the time she is launched, it is probable much progress will have been made with the construction of the new lock at Ramsden Dock, powers for the making of which are being obtained by the Furness Railway Bill, now before Parliament, which Bill has passed through its crucial stages without opposition. This lock will have a width of 100 ft. and a depth of 30 ft., and will be built so as to be used as a graving dock. As such it will be exceedingly useful for the repair of heavy tonnage ships, and will doubtless bring to Barrow much of the repairing trade. It is possible to launch the Japanese battleship and dock her safely by means of the present lock at Ramsden Dock, but the greater depth of water provided on the sill of the new lock will be required before she can leave Barrow when all her weight gets on her. The great difficulty Barrow shipbuilders have at present is the great scarcity of house accommodation for their workmen. As stated last month, 1,000 new houses are to be built by the company on Walney Island, but this is only part of a bigger scheme, as it is intended to bring into existence a new watering place, Walney-on-the-Sea, under the auspices of the Isle of Walney Estates Co., Limited, which has just been registered with a capital of £100,000, all of which is subscribed. The promoters are Messrs. Albert Vickers, of Vickers, Sons, & Maxim; James Dunn, late of the Admiralty, and now with Vickers; Alexander Adamson, manager of the Naval Construction Works; George Henry Pattinson, of Windermere; and John Poole. The work which this syndicate has in hand has already begun. It gives promise of one of the most interesting enterprises ever entered upon by gentlemen mainly associated with the shipbuilding trade, but there is a general belief that the scheme is a sound one, and only needs courage and determination to make it a great success financially.

The powerful hydraulic 100-ton crane situate alongside the engine and boiler shops of the Naval Construction Works, built by Sir W. Armstrong & Co., of Newcastle-on-Tyne, for the Furness Railway Co., has been owned by the latter ever since it was put up, until the present, but it has now been arranged to sell it to Vickers, Sons & Maxim, by whom it will be solely used in future. The work of improving its lifting power has been undertaken by its new owners, and by means of strengthening its radial base, and increasing its multiplication of power by adding other pulleys to the blocks, it will be made to lift 120 tons with ease. It has been found necessary to give the crane this additional power owing to the heavier weights to be lifted nowadays for the big battleships and cruisers.

Some idea may be obtained of the orders held by Messrs. Vickers, Sons & Maxim, Limited, at their Barrow works, and their position in reference to the acceptance of new mercantile orders, from the speech delivered by Mr. A. Adamson, the manager of the Naval Construction Works of the company on the occasion of the launch of the s.s. *Bornu*, for the British & African Steamship Co. He said he was very sorry that they were likely to come to an end, for the present time at least, of their orders for the British & African Co. They had been building ships for them for 10 years. The British & African Co. were one of the first customers of the Naval Construction Co., and since then they had always had business connections with them, being seldom without a British & African boat in the yard. They were pleased in one way, but sorry in another, that the great amount of Government work on hand made it quite impossible for the company to take any more merchant orders in the meantime. They had had a good many merchant ships on hand lately, but had been turning them out as quickly as they could. But in days to come, when the British & African Company were in the market for new ships, he hoped they might be able to come to terms to build for them again. Their relations with the British & African Co. had always been of the most pleasant, and he trusted it would always be a pleasure to them to come to Barrow with any new orders they might in the future place here. It is significant of the policy of Vickers, Sons & Maxim that their attention seems to be directed to the building chiefly of warships of all classes, but they propose also to build as much mercantile tonnage as they can possibly undertake when they have completed the exten- have to their already great yard now going on, and when they sions put down the new machinery which a bigger tonnage of output will necessitate. At present they have the British & African steamer *Bornu* to complete, and the Pacific Steam Navigation Co.'s steamer *Ortona* to launch and complete, and the *Clan Buchanan* to triple, and then their commercial tonnage on order for the present will be completed. It will not be long before other commercial work is undertaken if present indications may be taken as a criterion.



LIQUID FUEL CRUCIBLE FURNACE. FIG. 1.

West Cumberland.—The renewal of attention to the Whitehaven Shipyard, which it has for long been the hope of West Cumberland people to re-form into a company, seems again to have lapsed, as no local capitalist seems disposed to come forward to give the scheme "a leg up." Whitehaven is a moribund place, its population is on the decline, and its sons and daughters are making their exit to other places where there is greater scope for their energies than in the dead-alive town of their birth. Yet at one time Whitehaven was of as much importance as Liverpool, and was about the only port in the North-West of England that devoted any attention to the *building of ships; but that day* has passed, and, with the great yard at Barrow, and the smaller yards at Maryport and Workington, Whitehaven has been closed, in all probability, never to be opened again as a shipbuilding centre. There is a steady and brisk trade being done at Messrs. Williamson's yard at Workington, and orders are well held for various types of vessels of small tonnage, prospects being good for a constant run of orders. At Maryport business is fairly well maintained, but there is not a deal of spirit or enterprise shown in the work carried on here. A few orders are on hand and others are being arranged for.

The Duddon.—Shipbuilding at Duddon, on the estuary of that name, has never been carried on on a large scale, but it is noteworthy that, while iron ships have given way to steel ships, Duddon is a place where wooden ships have not yet given place to iron ships, although, it is strange to say, the port of Duddon is the most actively employed in iron ore exports of any port in the Kingdom. The Duddon Shipbuilding Co is now "busy" in building a three-masted schooner, 105 ft. between perpendiculars, of British oak. This wooden-walled trader will be locally owned, and will, it is probable, be followed by other orders, as schooners of this sort carrying a few hundred tons are profitably employed in the coasting trade, especially in the case of ports where only shallow-water approaches exist.

Shipbuilding Material.—There is a very brisk and active demand for all descriptions of shipbuilding material, and in many cases builders are being very much delayed in the work in hand by the difficulty they have in getting deliveries of specifications supplied to makers. The consequence is that the mills are all very briskly employed in the production of both heavy and light plates, and makers have work in hand which will keep them employed for a considerable time to come. Prices remain at satisfactory figures. Heavy plates are at £7 1s. 3d., and angles, which are also in large demand, are at £6 13s. 9d. There is great need on this coast of a modern angle mill built on economically workable lines, not only as means of supplying local but other buyers, such as those at Belfast, Glasgow, the Mersey, the Dockyards, and elsewhere. And the probabilities are that Barrow will be the place where this mill will be put down. The demand for heavy and light steel castings for shipbuilding and marine engineering purposes is well maintained, and this is one of the most actively employed and most profitably worked departments the Barrow Steel Co. possesses. There is a good demand for shipbuilding material sundries, and it is more and more certain every day that these sundries will gradually be produced at Barrow, as there is a tendency to locate here all the minor industries which are kindred to, and feeders of, the bigger establishments.

The Hematite Trade.—There is a marked improvement in the hematite pig iron trade this month, and indications are presenting themselves on every hand that the demand for metal will soon exceed the supply, especially as the former is growing, and it is impossible under present conditions to increase the latter, owing to the scarcity of iron ore and a shortage in the delivery of coke from the Durham and Burnley ovens. Makers are quoting 64s. to 66s. per ton for mixed Bessemer Nos. net f.o.b., and warrant iron is at 64s. 10d. net cash sellers, 64s. 9d. buyers. There is every prospect of America becoming a large buyer of hematite. If so, she can only get supplies from warrant stores, which stand at present at 226,000 tons. Makers are so well sold forward that they have no metal to offer for sale in anything like large parcels for prompt delivery.

Shipping.—The shipping trade is much more actively employed than was the case in the early months of the year. The exports of pig iron from West Coast ports this year represent 183,573 tons, and of steel 194,729 tons, showing a decrease in the former of 2,828 tons, and in the latter of 18,618 tons. It is probable shipments will largely increase before Midsummer is reached, as the foreign demand is likely to be of considerable volume. Freights are satisfactory, and profits good, but one serious drawback is the dearness of coal. This represents a greatly increased charge on steamship owners.

LIQUID FUEL CRUCIBLE FURNACE.

A SIMPLE, compact, and efficient device, in a portable form, by means of which a high temperature can be readily and quickly produced for any purpose, such as the fusing of metals, will, no doubt, be found a great convenience on board ship and in engineering works and shipyards.

The Bickford Burner Co., of Camborne, Cornwall, have given the subject of liquid fuel as a heating agent a considerable amount of attention, and have devised some appliances which we understand give very good results.

We have now the pleasure to illustrate (Fig. 1, page 130) and describe the patent liquid fuel crucible furnace which has just been placed on the market by the Bickford Burner Co., and which has been primarily designed for brass melting, but it will be readily understood that it is capable of dealing with other metals.

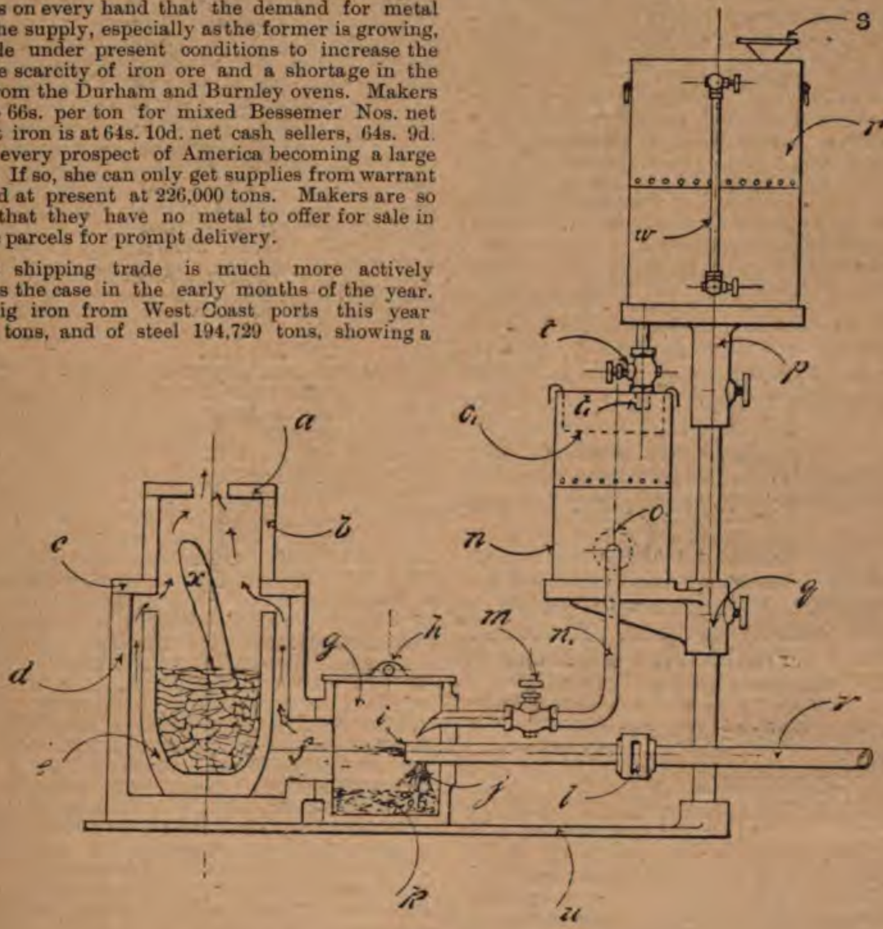


FIG. 2.

The adjoining illustration (Fig. 2.) shows the apparatus in part section. The oil is stored in an air-tight reservoir r and flows through a cock t into the filter tank n containing two filters o, o^1. As the only inlet for air into the reservoir r is through the pipe t^1 when the end thereof is not submerged, the flow from the reservoir stops when the oil level in the tank n reaches the end of the pipe t^1, and thus the level of the oil in n remains practically constant. From n the oil flows through the flexible steel hose n^1 and stop-cock m to the oil-spout, and thence round the air-nozzle i to the slot j, by the air issuing from which it is blown to the bottom of the combustion chamber g, amongst the broken brick k.

The resulting flame is blown through the hole f into the furnace d around the crucible e and up through the warming cylinder *b*, so as to heat the overlapping charge *x*. Air is supplied from any convenient source, through the slide-valve *l*. When the warming cylinder is not required, the small lid *a* is placed on the large lid *c*. The cover *h* of the combustion chamber *g* and rim of the latter are machine-faced so as to make a flame tight joint; the cover is not fastened down in any way.

To start the device, all that is necessary is to lift the lid of the combustion chamber and place therein a bit of lighted waste or other inflammable material, then turn on the oil and air valves *m* and *l*, and as soon as the oil catches alight, replace the lid of the combustion chamber and adjust the oil till the flame appears about four inches above the cover.

The objection to liquid fuel apparatus that is commonly, and in many cases justly, urged is that it is liable to choke and is complicated to work. It is an interesting fact to note that in this device there is no pipe or hole through which the oil passes which is less than ¼-inch bore, and, further, the oil passes through a double filtering arrangement.

The makers put forward an interesting comparison between coke and oil in the fusion of brass. The quantity they take is 40 lbs.: to fuse which, ¼ cwt. of coke at 1s. 3d. per cwt., costing 3·75d., must be used; to which must be added the cost of two hours' labour, including carrying coke and laying and clearing fires, equal to 8d.—together 11·75d. If carried out by oil, the cost will be ½ gallon of creosote heavy green oil 1d., and ½ hour's labour 2d., together making 3d. So that the oil fuel only costs a quarter the cost of coke.

The Bickford Burner Co. also make a petroleum Bunsen burner, which has been specially contrived for steam-raising purposes. It is extremely simple in construction and can be easily regulated. The burner requires neither steam nor air-blast and can be started all cold in from five to seven minutes.

OBITUARY.

ALEXANDER STEPHEN, SHIPBUILDER.

THE death took place in Glasgow on the 19th ult. of Mr. Alex. Stephen, the senior partner in the well-known Clyde shipbuilding and engineering firm of Messrs. Alex. Stephen & Sons, Linthouse. About six weeks prior to the sad event, the deceased gentleman, who was in his 67th year, contracted a severe cold which developed into influenza, and although apparently recovering, he had a relapse and gradually sank, until he finally succumbed on the morning of the 19th, within his town residence at Park Terrace. The late Mr. Stephen came of a shipbuilding race; his father, Alexander Stephen, being the founder of the shipbuilding business of A. Stephen & Sons, long established at Dundee, and subsequently also of the offshoot business on the Clyde, of which the deceased gentleman eventually became head partner. He was born at Arbroath on the 25th April, 1832, having thus before his death attained his 67th year, and was one of the oldest living Clyde shipbuilders. He was educated in Aberdeen and Dundee, and studied subsequently at Edinburgh University, where, with the practical sagacity which has marked his highly successful career all through, he gave special attention to the subjects bearing most directly on his future profession. His apprenticeship, as a shipwright, was commenced under his father in Dundee, in 1849, exactly 50 years ago, and he was looking forward to the celebration of his working jubilee with pleasurable anticipation previous to his illness. In 1852—three years later—*he came to Glasgow,* where he joined his father in the business at Kelvinhaugh, still existing as the Kelvinaugh Slip-dock and Shipyard. The business at Dundee was then, and for long, carried on by his father and brother William. In 1861 the deceased Mr. Stephen created a stir in shipbuilding circles by introducing a style of shipbuilding known afterwards as the "composite" system, where iron took the place of wood in several parts of the ship, especially in the framework, and his lead in this new departure was followed, not only by his fellow shipbuilders on the Clyde, and in England, but by the Admiralty as well. Finding, in the course of time, the premises at Kelvinhaugh too limited, and to meet the growing demand for steam vessels in ocean navigation, the firm bought in 1868 the fine old estate of Linthouse, where works and plant for both engineering and shipbuilding were erected, which are to-day amongst the finest and most complete on the Clyde or elsewhere. Mr. Stephen was a man who gave close and constant attention to his business, and to this marked characteristic of the man is due mainly his great success. He was one of the very few who were at once heads of firms and able to make their ship-models with their own hands. His vessels became known not only for soundness of construction, but for beauty of form, and many of them have had eventful histories. One, for instance, after doing splendid service as the *Sea King*, in the peaceful capacity of a China tea clipper, was converted into the notorious Confederate cruiser *Shenandoah*, and ultimately became the Sultan of Zanzibar's yacht. Among mail steamers built by Mr. Stephen were some for Brazil, and in 1872 the Emperor of that State decorated him with the order of a "Knight Officer of the Rose." Mr. Stephen's firm has also all along built for important shipping concerns, such as the Hamburg-American Co., Messrs. Sloman (Hamburg), the Anchor Line, the Clan Line, and the Allan Line, for the last of which they have on hand at present a magnificent twin-screw steamer of over 10,200 tons. A conspicuous feature of the yard has always been the large travelling crane which traverses the building berths for the purpose of putting engines and boilers on board. It has been the practice of the firm for years to launch their boats, except in special instances, with engines on board. One very serious and lamentable disaster befel the firm twenty years ago, when the *Daphne* toppled over on leaving the ways, several hundred men being drowned. It was a catastrophe that afflicted Mr. Stephen very sorely, and from which he did not recover for many a year. The deceased gentleman leaves a widow and three sons and three daughters to mourn his loss, most of whom are married—the two eldest sons, Mr. Alexander E. Stephen and Mr. Fred. J. Stephen, being partners in the old-established firm at Linthouse. About eleven years ago, when his sons were beginning to take share of the cares of the business, Mr. Stephen purchased the pretty sylvan retreat known as Kelly Estate, at Wemyss Bay, from the trustees of the family of the late James Young, of paraffin fame, where he demolished the old mansion-house and built himself a beautiful home, where he spent the greater part of the years since its completion. His close application to business, and the pleasure he took in his work, kept him away from what is commonly called "public life," but he found time for some good service in this direction also. He was the first chairman of the Govan School Board, where he sat for many years, and in 1882 and 1883 he was Lord Dean of Guild for the city, and filled both positions with credit and distinction. He was for some years chairman of the Technical College, Glasgow, and was held in high esteem by all leaders of education in the city.

The New Liverpool Dock is 925 ft. long, 94 ft. wide at entrance, and the sill 13 ft. 3 in. below O.D.S. The capacity of the dock is 3,226,648 cubic feet, and for emptying the dock there are three 51 in. centrifugal pumps, capable of pumping about 1000 tons a minute. The 80,000 tons of water in the docks were taken out in an hour and forty minutes.

Lowestoft Low Lighthouse.—This lighthouse is being moved 250 ft. further inland by a local contractor, under the supervision of a representative of the Trinity House, in consequence of the encroachment of the sea upon that portion of the eastern coast between Harwich and Great Yarmouth. This will be the third time the lighthouse has had to be removed further back.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Northwood Ho.—On April 8th there was launched at Hull, for Messrs. S. T. White & Co., Limited, of Hull, an iron steam ketch, of about 152 tons gross, named the *Northwood Ho.*

Britannia.—On April 10th there was launched at Plymouth, for the Volonga State Co., of London, a wooden sailing schooner, of about 106 tons gross, named the *Britannia.*

Arcadia.—On April 15th there was launched at South Shields, for an Austrian firm, a steel schooner-rigged steamer, of about 3,143 tons gross, named the *Arcadia.*

Manu.—On April 24th there was launched at Sunderland, for Hijos de Astigarraga, of Bilbao, a steel schooner-rigged steamer, of about 2,060 tons gross, named the *Manu.*

Gottfried.—On April 25th there was launched at Sunderland, for Mr. G. Sjoberg, of Malmö, a steel schooner-rigged steamer of about 1,284 tons gross, named the *Gottfried.*

Tullochmoor.—On April 25th Messrs. William Doxford & Sons, Limited, launched at Pallion, Sunderland, the cargo turret steamer *Tullochmoor*, built to the order of Messrs. Walter Runciman & Co., and the directors of the Moor Line, Limited, Newcastle. The *Tullochmoor* is a duplicate of the *Peachmoor*, built by Messrs. Doxford to the order of the same firm. Her dimensions are 340 ft. in length; 45 ft. 6 in. in breadth; and 27 ft. 3 in. in depth, moulded. She has a carrying capacity of about 5,800 tons, on a draught of 22·2 ft. Her gross tonnage is 3,480, and her net tonnage, 2,220. The engines are built also by Messrs. Doxford, and have 26 in., 42 in. and 68 in. cylinders, with 42 in. stroke.

Conqueror.—On April 26th Messrs. Willoughby Brothers, Limited, launched at Plymouth, a steel screw vessel, the *Conqueror*, built for Mr. George Etheridge, of London. The dimensions of the vessel are:—Length, between perpendiculars, 85 ft· 2 in.; breadth, 18 ft.; depth, 10 ft. 5 in. The engines are compound surface-condensing, having cylinders 17 in. and 34 in. diameter, 21 in. stroke. The hull and machinery were built under Lloyd's special survey.

Sophron.—On April 26th there was launched at Hull, for the Standard Steam Fishing Co., Limited, of Grimsby, an iron steam ketch, named the *Sophron.*

Manchester Port.—On April 26th there was launched by Messrs. Palmer's Shipbuilding and Iron Co., Limited, from their Jarrow yard, a finely modelled steel screw cattle and cargo steamer named the *Manchester Port*, built to the order of the Manchester Liners, Limited, of which Sir Christopher Furness is chairman. The vessel is built expressly for the Manchester Liners' service from the Manchester Canal to Canada, and when fully laden she will be of a draught perfectly suitable for the canal. She is six feet longer than the *Manchester City*, at present running, and will be the longest boat which has as yet used the Manchester Ship Canal. Her dimensions are, viz., length 467 ft. by 52 ft. beam and 39 ft. depth, has four masts, and is rigged fore-and-aft with telescopic topmasts and funnel to suit the Manchester Canal bridges, and has been built under special survey to take the highest class in Lloyd's registry. She is of the three-decked type, with two steel decks laid all fore-and-aft, and has an iron shelter deck specially strengthened considerably in excess of Lloyd's requirements for the Atlantic trade, extending over the whole length, and above this is a bridge deck 130 ft. long. All the available space under the shelter deck, and along each side under the bridge deck, is fitted throughout to pass American and Canadian regulations, with the most improved and modern arrangements for carrying about 700 head of cattle. The accommodation for the saloon, captain's, and spare staterooms, &c., is arranged on the bridge deck in a large steel deckhouse, with separate houses for officers and engineers. The seamen and firemen are housed under the shelter deck forward, and the cattlemen's quarters are under the shelter deck aft. A cellular double-bottom is fitted all fore-and-aft for water ballast, and also four separate tanks under engine and boiler space for fresh water for supplying cattle. Water ballast is also arranged to be carried in a deep cargo tank and in the after peak, giving the vessel a total water ballast capacity of over 2,000 tons. The displacement of the vessel is about 14,500 tons, and she is divided into nine watertight compartments by means of eight steel bulkheads, all of which extend to the upper deck. Each compartment is fitted with complete grain divisions. A most complete system of ventilation has been arranged to ensure the safe carriage of cattle, grain, or other cargoes. The vessel has 10 hatches, 12 powerful steam winches, and 20 derricks provided for the rapid loading and discharging of cargoes. Aft of the engine-room the 'tween decks are insulated and fitted with the necessary refrigerating plant, specially arranged for the conveyance of fresh beef, mutton, poultry, fruit, butter, &c. A powerful steam windlass is fitted forward for working the cables, and a combined hand and steam-steering gear of special design is fitted in a large steel wheelhouse on the after end of the shelter deck. The vessel is lighted throughout by electricity. The engines are also being constructed by the Palmer's Co.; they are of the inverted triple-expansion type, having cylinders 30 in., 50 in. and 81½ in. by 54-in. stroke, steam being supplied by three double-ended boilers 14 ft. 6 in. diameter by 17 ft. 6 in. long, with a working pressure of 180 lbs. All the shafting is of hydraulic compressed steel, and is considerably in excess of Lloyd's requirements. The propeller is of manganese bronze, and all the auxiliary machinery is of the most modern type.

Undaunted.—On April 27th there was launched at Selby, for the Grimsby Union Steam Fishing Co., Limited, of Grimsby, an iron steam ketch, named the *Undaunted.*

Barton.—On April 27th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw-steamer of the following dimensions:—Length between perpendiculars 330 ft.; breadth extreme, 47 ft.; depth, moulded, 27 ft. 4 in. The steamer has been built to the order of Messrs. Webster & Barraclough, West Hartlepool, and is off the three-decked rule, fitted with the builders' patent trunk, full poop, bridge, and topgallant forecastle. The saloon and cabins for captain and officers will be fitted up in the poop, the accommodation for engineers in iron houses on the bridge deck, and for the crew in the forecastle, as usual. She has double-bottom on the cellular principle for water ballast, and will carry about 5,750 tons on Lloyd's summer freeboard, on a light draught of water. She will have all the most recent appliances for the expeditious and economical loading and unloading of cargoes, has direct steam windlass, steam-steering gear amidships, with powerful screw gear aft, six large steam winches, to which steam is supplied by a large horizontal multitubular donkey boiler, stockless anchors, &c. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, having cylinders 24 in., 40 in., 65 in., by 42 in. stroke. The christening ceremony was gracefully performed by Miss Mary Webster, daughter of Mr. E. A. Webster, of Wolviston Hall, who gave her the name of *Barton.*

Oriflamme.—On April 27th this vessel was successfully launched by Messrs. Armstrong, Whitworth & Co. Limited, from their Walker Shipyard. She is the first of three vessels being built by that firm to the order of Messrs. Lane & Macandrew, of London, on behalf of MM. Desmarais Frères, of Paris, and is specially designed for the carriage of petroleum in bulk. This vessel and her sister ships are being constructed under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool; and are to obtain the highest class of Bureau Veritas, and to conform with the Suez Canal regulations for oil steamers. The principal dimensions are:—Length, 347 ft.; breadth, 45 ft.; depth, moulded, 29 ft. 6 in.; and the engines, constructed by the Wallsend Slipway and Engineering Co., have cylinders of 24 in., 40 in. and 64 in., taking steam from two large single-ended boilers working at 160 lbs. pressure, and having a heating surface of about 5,300 sq. ft. It is expected that this machinery will prove capable of propelling the vessel at a speed of 10½ knots when laden with a deadweight of 5,500 tons. Electric light is fitted throughout the vessel, and the pumping installation is especially handy and powerful, and capable of dealing with oil cargoes with great rapidity.

Parana.—On Thursday, April 27th, Messrs. W. Gray & Co., Limited, launched a fine steel screw-steamer, which they have built to the order of Messrs. Morel, Limited, of Cardiff. She will take Lloyd's highest class, and is of the following dimensions:—Length over all, 336 ft.; breadth 47 ft.; depth, 24 ft. 10 in., with full poop, bridge, and topgallant forecastle. A tasteful saloon and the captain's and officer's rooms will be fitted in a large house on the bridge, and the engineer's rooms will also be on the bridge. The hull is built with web frames, and double bottom under each hold for water ballast. Two large patent donkey boilers, seven steam winches, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, iron longitudinal grain divisions, stockless anchors, and a complete outfit will be fitted for a first-class cargo boat. Fine triple-expansion engines are being supplied by the Central Marine Works of Messrs. W. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in. Steam will be supplied by two large main boilers, at a working pressure of 160 lbs. per square inch. The vessel has been constructed under the superintendence of Mr. C. E. Kendall on behalf of the owners, and the ceremony of christening her *Parana* was gracefully performed by Miss Winifred Fea, youngest daughter of Mr. J. P. Fea, J.P., West Hartlepool.

Weissenfels.—On Thursday, April 27th, Messrs. Wigham, Richardson & Co. launched from their Neptune Shipyard the s.s. *Weissenfels*, which they are constructing to the order of the Deutsche Dampfschifffahrts-Gesellschaft "Hansa," of Bremen, for their Eastern service. The steamer is 370 ft. in length by 46 ft. beam by 30 ft. deep, and is being fitted with quadruple-expansion engines, balanced on the Yarrow, Schlick & Tweedy system, being the eighth set of engines built on this system by Messrs. Wigham, Richardson & Co., for the "Hansa" Co., and there are two more in course of construction. The vessel, which has a limited amount of passenger accommodation, has teak decks, and will be very completely provided with all the most modern appliances for handling her cargo most quickly and economically. The christening ceremony was gracefully performed by Miss Phyllis Young, of Tynemouth.

India.—On April 28th Sir Raylton Dixon & Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw-steamer, built to the order of the Austrian Lloyd's Steam Navigation Company, Trieste. She is built to Lloyd's highest class, spar deck rule. Her principal dimensions are 320 ft. by 44 ft. by 23 ft. 9 in., and she has a deadweight carrying capacity of about 4,600 tons on a light draught of water. The spar and main decks are of steel, and poop, bridge, and forecastle decks of pitch pine. She is fitted with water ballast in cellular double bottom, five watertight bulkheads, &c., with accommodation for captain and officers in houses on bridge deck. She will be fitted with triple-expansion engines by Messrs. Sir C. Furness, Westgarth & Co., Limited, Middlesbrough, having cylinders 25 in., 40 in., 66 in. by 45 in. stroke, supplied with steam by two large boilers working at 180 lbs. pressure. On leaving the ways she was gracefully named *India* by Signorina Fausta Vecchi, daughter of Signor Vico Vecchi, resident inspector for the owners.

Albatross.—On April 29th there was launched at Middlesbrough, for the Manchester and Liverpool Transport Co., Limited, of Manchester, a steel schooner-rigged steamer, of about 570 tons gross, called the *Albatross*.

Adalia.—On April 29th there was launched at Sunderland, for the Papayanni Steamship Co., Limited, of Liverpool, a steel schooner-rigged steamer, of about 3,848 tons gross, named the *Adalia*.

Cedric.—On April 29th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard a new steam trawler, of the following dimensions:—112 ft. by 21 ft. by 11 ft. 6 in. depth of hold, built to the order of the United Steam Fishing Co., Limited, Grimsby. Triple-expansion engines are being supplied by Messrs. C. D. Holmes & Co., Hull, and the vessel will be completed, ready for sea, with the most modern appliances for trawling. Mrs. G. Woods, of Grimsby, named the vessel *Cedric*, and after the ceremony the company adjourned to the office of the builders for luncheon.

Brimsnes.—On April 29th there was launched at North Shields an iron steam ketch, of about 160 tons gross, named the *Brimsnes*.

Isis.—On April 29th there was launched at Hull, for Messrs. Roberts & Ruthven, Limited, of Grimsby, an iron steam ketch, named the *Isis*.

Standard.—On April 29th there was launched at North Shields a steel steam ketch, of about 170 tons gross, named the *Standard*.

Emily.—On May 1st Messrs. Fellows & Son launched at *Southtown*, Yarmouth, the barge *Emily*, built by them for the Naval Ordnance Department, of Plymouth, and specially arranged to carry gunpowder, guns, &c. Her dimensions are:—Length, 86 ft.; beam, 20 ft.; depth, 7 ft.; and her carrying capacity 140 tons.

Caprice.—On May 5th Messrs. Summers & Payne launched at Southampton the 52-foot racing yacht *Caprice*, built to the order of Sir Henry Seymour King, M.P., commodore of the Royal London Yacht Club. The *Caprice* has been designed by Mr. Arthur E. Payne.

Abbey Holme.—On May 6th Messrs. Joseph L. Thompson & Sons, Limited, of the North Sands Shipbuilding Yard, Sunderland, launched this vessel. She has been built to the order of Messrs. Hine Brothers, of Maryport, and is the sixteenth vessel built by this firm for these owners. She is built to Lloyd's highest class, under their special survey on the spar deck rules, and is 358 ft. in length, over all, by 45 ft. 3 in. breadth, extreme, by 26 ft. 7 in. depth, moulded, and is constructed to have a large measurement and deadweight capacity on a moderate draught of water. The accommodation for captain, officers and engineers, saloon, separate messrooms for officers and engineers, and four spare berths for the accommodation of eight passengers, is in houses placed on the bridge deck; the crew, firemen, and petty officers being berthed in the topgallant forecastle. There is a large teak steering and chart house placed on top of the saloon house, the steering engine being fitted at the after end of the engine casings connected with controlling gear to the bridge. The poop and bridge space is entirely clear, and is arranged for the accommodation of cargo. The vessel has six watertight bulkheads, and the whole of the cellular double-bottom is fitted for the carrying of water ballast, which will also be carried in the after peak. The vessel is rigged as a two-masted fore-and-aft schooner, with telescopic masts, to enable her to go under the Manchester Canal bridges. The deck machinery is of a powerful description, and consists of eight steam winches with double derricks at the hatches, and a powerful steam windlass fitted on the forecastle head for the working of the anchors, which are of the patent stockless type; the deck machinery is supplied with steam by a large multitubular donkey boiler working at 180 lbs. pressure. The vessel is also arranged for the carrying of cattle, with ventilators fitted to suit the Board of Trade requirements, and has condenser for providing fresh water daily. As is usual with this line of boats, the vessel has a clipper stem ornamented with a neat figurehead (a likeness of Mrs. Robert Thompson) and trail boards. The vessel throughout has been specially constructed for the owners' Canadian, American, and other trades. The engines and boilers have been constructed by Messrs. George Clark, Limited, of Sunderland, the sizes of the cylinders being 23 in., 39 in., 66 in., with a stroke of 42 in., supplied with steam by two large multitubular boilers working at 180 lbs. pressure. The crank shaft is of forged steel from the Cyclops Works of Messrs. Cammel & Co., Limited, of Sheffield. The vessel and machinery have been constructed under the personal supervision of Captain George Brown, the owners' superintendent. The launch, which was effected by hydraulic power, was most successful in every way. The vessel was named by Mrs. Robert Thompson (Langham Tower), wife of the managing director of the builders' firm. There were also present Mr. Wilfred Hine, J.P. (one of the managing owners of the vessel), Mr. John McL. Hine, Captain George Brown, and a numerous company. It is interesting to note that Messrs. Hine Brothers first *Abbey Holme*, an iron sailing barque of 510 tons register, was built exactly thirty years ago on the same site as on which the present ship has been built. The first *Abbey Holme* had a long and successful career, but became a total loss at the mouth of the Tyne some years ago.

Kumara.—On May 8th there was launched from the East Shipbuilding Yard of C. S. Swan & Hunter, Limited, Wallsend, a large, finely modelled screw-steamer, which has been built to the order of the Shaw Savill & Albion Co., Limited, of London. The principal dimensions of the vessel are:—Length over all, 438 ft.; beam extreme, 54 ft. 3 in.; and depth, moulded, 32 ft. 10 in. to upper deck; and she has been built to take Lloyd's highest class three-deck rule. Above the upper deck a shelter deck has been fitted right fore and aft, at the fore end of which are berthed the crew and firemen, and at the after end provision has been made for carrying a number of steerage passengers. Accommodation for the officers, engineers, and a few first class passengers will be provided in large deck houses on the shelter deck, above which will be the captain's room, chart room, and a comfortable smoke room. One hold forward of the machinery space and one aft will be insulated for the carriage of frozen mutton, of which the steamer is intended to carry the large number of 100,000 carcasses, the refrigeration being done by two large freezing engines, which are being built by the Haslem Foundry and Engineering Co. The machinery, which is being built by the Central Marine Engine Works, West Hartlepool, will consist of a set of triple-expansion engines, having cylinders 32 in., 54 in., and 86 in. diameter, with a piston stroke of 54 in., steam being generated in five single-ended boilers, 15 ft. 6 in. diameter and 10 ft. 6 in. long, working at a pressure of 180 lbs. per square inch. During construction, the vessel has been under the superintendence of Captain McKirdy, the marine superintendent of the owners, assisted by Captain Scotland, and the machinery under that of Mr. T. Young, their superintendent engineer. On leaving the ways the naming ceremony was gracefully performed by Miss Scotland.

Nordpol.—On May 8th there was launched by the Northumberland Shipbuilding Co., Limited, at Howdon-on-Tyne, the steel screw-steamer *Nordpol*, built to the order of Messrs. Harloff & Boe, of Bergen, and designed to carry 6,300 tons. She is said to be the largest Norwegian-owned steamer yet built. The principal dimensions are:—Length, 352 ft.; breadth, 48 ft.; and depth, moulded, 28 ft. 5 in. She has been built to the highest requirements of Lloyd's registry, and also of the Norwegian Veritas. The propelling machinery has been constructed by Messrs. Richardson & Sons, Limited, of Hartlepool, and consists of a set of triple-expansion engines, having cylinders 24 in., 39 in., and 66 in. in diameter, by 45 in. stroke, supplied with steam by two boilers 16 ft. by 10 ft. 6 in. long.

Bornu.—On May 9th there was launched at Barrow, for the British and Africa Steam Navigation Co., of Glasgow, a steel schooner-rigged steamer, named the *Bornu*.

Crewe.—On Tuesday, May 9th, Messrs. Wood, Skinner & Co., Limited, successfully launched from their shipbuilding yard at Bill Quay, Newcastle-on-Tyne, a handsome new steel screw-steamer which they have built to the order of Messrs. Dent & Co., Quayside, Newcastle-on-Tyne. The vessel is a very fine specimen of a modern cargo boat, of the improved single-deck type, with poop, long bridge, and topgallant forecastle, and is of the following dimensions, viz.:—Length over all, 338 ft.; breadth, 48 ft.; depth, moulded, 24 ft. She is constructed to carry 5,100 tons deadweight, on about 20 ft. 6 in. draught of water, and has been built under special survey of Lloyd's for their 100 A1 classification, and has also been superintended during construction by Mr. J. Baxter, of Newcastle, the owners' surveyor. The vessel is rigged as a fore-and-aft schooner, with fidded topmasts, and is fitted with all the most modern description of deck machinery and other appliances for the efficient working of the vessel generally, and for facilitating the rapid loading and discharging of cargo. The saloon, captain's accommodation, and spare berths are in a large house on the bridge deck amidships; the chartroom is on flying bridge above; the officers' accommodation being in side houses, while the crew are berthed in the topgallant forecastle. The vessel is provided with water ballast in the cellular double bottom, all fore and aft. She will be fitted with a set of triple-expansion engines of the improved type, having cylinders 23½ in., 39 in., and 64 in. diameter respectively, with a stroke of 42 in., steam being supplied by two large steel multitubular boilers, working at 160 lbs. pressure per square inch. The machinery has been constructed and will be fitted by the North-Eastern Marine Engineering Co., Limited, at the Northumberland Engine Works, Wallsend-on-Tyne. The ceremony of christening the vessel was gracefully performed by Miss Cissy Dent, of Newcastle, who named the steamer *Crewe*.

Wellington.—On May 9th there was launched from Mr. Joseph Scarr's shipyard at Grovehill, Beverley, a steel screw-tug of the following dimensions:—Length over all, 69 ft.; beam, moulded, 16 ft. 5 in.; depth amidships, 9 ft. 4 in. She was built to the order of Mr. J. Constant, of London, and is the third tug built for the same owner. The vessel has been built to class A1 Lloyd's. As the vessel left the ways she was christened *Wellington* by Miss Gertrude Scarr, daughter of the builder.

Isernia.—On May 10th there was launched at Hull, for the Great Grimsby and East Coast Steam Fishing Co., Limited, of Grimsby, an iron steam ketch, named the *Isernia*.

Ohio.—On May 10th there was launched by Messrs. Bartram and Sons, at Sunderland, a steamer of the spar-deck type, built for the Neptune Steam Navigation Co., Limited, for whom Messrs. W. & T. W. Pinkney, Sunderland, are the managers. The vessel has been especially designed to suit the American trade, and has passenger accommodation of first-class order. Her dimensions are:—Length, 410 ft.; breadth, 46 ft. 6 in.; and depth, 29 ft. 6 in. The propelling machinery will be provided by Messrs. George Clark, Limited, the cylinders being 25½ in., 43 in., and 73 in. by 48 in. She is constructed to carry 6,000 tons of cargo, and is expected to accomplish 12 knots an hour loaded. The vessel, which was christened the *Ohio*, has been built to replace a former liner of the same name, and is the largest vessel now owned by the firm.

Saxon Prince.—On May 10th Messrs. Short Brothers launched from their shipbuilding yard at Pallion a finely modelled steamer of about 6,000 tons capacity, which they have built for the Prince Line, Limited, of Newcastle-on-Tyne, and which is the first of a description of steamers they are building for the West Indian Line. This steamer, which is built of steel, has been constructed under special survey to the highest class in Lloyd's register, and is of the following dimensions:—Length over all, 363 ft.; breadth, 45 ft.; and depth, moulded, 27 ft. 9 in. The vessel is divided by six watertight bulkheads, forming four large cargo holds, for working which there are six powerful steam winches with large donkey boiler. The double bottom is constructed for water ballast throughout, divided into trimming tanks. There is a short full poop, bridge house amidships, over top of which are large houses for the accommodation of captain, officers, and engineers, and a few passengers—the saloon being large and commodious, and fitted up in polished hardwoods, tastefully arranged, and lighted by electricity. On top of midship cabin-house are the wheel-house and chart-house and flying bridge. The steering gear is fitted in the engine-room with controlling rods to wheel-house. The crew are berthed in the topgallant forecastle. On leaving the ways the vessel was named *Saxon Prince*, the ceremony being gracefully performed by Miss Nora Donald, daughter of the vice-chairman of the company. The vessel is to be fitted by Messrs. Thomas Richardson & Sons, Limited, of Hartlepool, with engines having cylinders 24 in., 39 in., and 66 in., with a stroke of 45 in., steam being supplied by two large steel boilers working at 180 lbs. pressure.

Toxteth.—On May 10th there was launched at Liverpool, by Messrs. John Jones & Sons, the *Toxteth*, sister ship of the *Nelson*, recently delivered by the builders to the Alexandra Towing Co., Limited.

Brinkburn.—On May 11th there was launched at Whitby, by Messrs. T. Turnbull & Son, a large steel screw-steamer, to the order of Messrs. Harris & Dixon, of London. The dimensions of the vessel are as follows:—Length over all, 361 ft. 3 in.; length between perpendiculars, 350 ft.; breadth, extreme, 43 ft.; depth to top of ordinary floor, 28 ft. 6¼ in.; class, 100 A1, spar-deck, at Lloyd's. Messrs. Blair & Co. will supply direct-acting triple-expansion engines, having cylinders 24 in., 40 in., and 65 in., stroke 42 in.; two steel boilers, 160 lbs. working pressure. Deadweight carrying capacity, about 5,600 tons. The vessel was christened the *Brinkburn*, and is similar in dimensions to the *Hutton*, the last vessel built by the firm.

Inchkeith.—On May 11th Messrs. William Gray & Co., Limited, launched from their Central Shipyard the handsome steel screw-steamer *Inchkeith*, of the following dimensions, viz.:—Length between perpendiculars, 348 ft.; breadth, 47 ft.; depth 28 ft. 1½ in.; and deadweight capacity 5,600 tons on 22 ft. 5 in. draught. The vessel is an enlargement on the s.s. *Inchmona*, which was launched from the same yard three years ago, and which has marked an epoch in steamship efficiency. She is of an improved spar deck type with large measurement capacity, having poop, long bridge, and topgallant forecastle, with all the cabin, officers', and engineers' accommodation on the bridge. She is fitted with a double bottom forward, and a deep cargo tank aft, and has a total water ballast capacity of 1,287 tons. The machinery, from the Central Marine Works, of W. Gray and Co., Limited, consists of a set of Mudd's patent five-crank engines, working in quadruple expansion, supplied by steam at a working pressure of 260 lbs. per square inch, from two ordinary marine type boilers fitted with induced draught. The engines will develop more power than those of the *Inchmona*, which have given highly satisfactory results, and have fully justified the owners and builders in making such a large departure from the beaten track in the design of marine engines. Messrs. Hamilton, Fraser & Co., of Liverpool, the owners of the vessel, are to be congratulated upon the success of their enterprise in having the *Inchmona* built, and from the experience gained with her and the improvements made in the new ship and her machinery, even better results are assured to them in the s.s. *Inchkeith*. The steamer will take Lloyd's highest class, and has been constructed under the superintendence of Mr. J. B. Edmiston, assisted by Captain F. G. Major and Mr. T. S. Mossman. The ceremony of naming the vessel *Inchkeith* was gracefully performed by Miss Dorothy Cresswell Gray, Staincliffe, Seaton Carew.

Shandon.—On May 11th Messrs. Richardson, Duck & Co. launched from their yard a steel screw-steamer of the following dimensions:—Length over all, 352 ft.; breadth, extreme, 48 ft.; depth, moulded, 28 ft. 4 in.; tonnage, gross, about 3,860 tons, with a carrying capacity of about 6,500 tons. This steamer, which has been built to the order of Mr. W. J. Tatem, of Cardiff, will class 100 A1 in Lloyd's register, and has been built under special survey. She is the largest steamer yet built for Cardiff. The vessel is of the three-deck type with one laid deck; having cargo poop, long extended bridge with houses for captain, officers, and engineers' accommodation on bridge deck, and topgallant forecastle for crew. A cellular double bottom, and fore and aft peak tanks are fitted for water ballast; and the equipment includes six steam winches, large horizontal donkey-boiler, stockless anchors, steam windlass, steam-steering gear, &c. The engines, by Messrs. Blair & Co., Limited, have cylinders 25 in., 42 in., and 68 in. by 45 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 160 lbs. As the vessel left the ways she was christened the *Shandon* by Mrs. Tatem, of Cardiff.

Celtic.—On May 12th there was launched by Mr. James Miller, at St. Monan's, a first-class fishing boat, built to the order of Mr. James Mackay. The craft, which was named the *Celtic*, is 62 ft. in length, with a breadth of beam 21 ft. 6 in.

Otta.—On May 13th there was launched by Messrs. John Priestman & Co., at Southwick, Sunderland, a handsomely modelled screw-steamer, built to the order of Mr. Lauritz W. Hanson, of Bergen, Norway. Her dimensions are:—Length, 336 ft.; breadth, 47 ft.; depth, moulded, 26 ft. 10 in. The vessel has been constructed to "Der Norske Veritas" and Lloyd's highest class, three-deck rule. A full poop is fitted aft, long bridge amidships, and topgallant forecastle. The hold is divided into watertight compartments by five steel bulkheads, and a double-bottom forward and aft divided into four separate tanks, together with the after-peak, provide ample water ballast. The engines are of the triple-expansion type, and have been built by Messrs. Wm. Allan & Co., Limited, and have cylinders of 25 in., 41 in., and 67 in. by 45 in. stroke. The boilers supply steam at a pressure of 160 lbs. per square inch. Mrs. Anderson, of South Shields, named the vessel *Otta*.

Stat.—Lately there was launched from the yard of Wm. Harkess & Son, Middlesbrough-on-Tees, a steel screw-steamer, 160 ft. by 25 ft. by 13 ft., built to the order of a Norwegian firm for their fishing trade on the coast of Norway. She will be fitted with triple-expansion engines by Sir C. Furness, Westgarth & Co., Limited, and be classed 100 A1. Lloyd's. She was named *Stat*.

LAUNCHES.—Scotch.

Balmoral Castle.—On April 8th there was launched from the yard lately occupied by Messrs. Donaldson, Aitken & Scott, Govan, the iron screw-trawler *Balmoral Castle*, built for Mr. J. A. Smith, fish merchant, Hull. The vessel, along with others, was contracted for by the firm mentioned, and the work is now being finished by Messrs. Cochrane & Cooper, of Beverley, on behalf of the owner. The vessel is 115 ft. in length, 21 ft. broad, and 11 ft. 3 in. deep. She will be registered 100 A1 at Lloyd's, and will have triple-expansion engines by Messrs. Anderson & Co., Pollokshaws.

Irishman.—On April 22nd the Irvine Shipbuilding and Engineering Co., Limited, Irvine, launched a steel screw-steamer of 250 tons deadweight, to the order of Messrs. John Kennedy & Sons, Glasgow. The vessel has been built for the owners' coasting trade, her dimensions being 120 ft. by 21 ft. 6 in. by 9 ft. 6 in. Messrs. Muir & Houston, Limited, Glasgow, are supplying machinery of the c.s.c. type, having cylinders 16 in. and 32 in. by 22-in. stroke, with a large steel boiler working at 130 lbs. pressure. The vessel was named *Irishman*.

San Salvador.—On April 24th there was launched at Port-Glasgow a steel schooner-rigged steamer, of about 1,860 tons gross, named the *San Salvador*.

Steel Screw Steamer.—On April 24th Messrs Russell & Co., Port-Glasgow, launched a steel screw-steamer of the partial awning-deck type to their own account. The dimensions are:—Length, 237 ft.; breadth, 34 ft. 6 in.; depth, 17 ft. 6 in. This steamer has been built to Lloyd's highest class, and is specially constructed for the Baltic and light-draught trade. Messrs. Kincaid & Co., Greenock, will supply the machinery, the cylinders being 17½ in., 28½ in., and 46½ in. by 33 in. stroke.

Equator, Erne, and Emulator.—On April 24th Messrs. Mackie & Thomson launched from their yard at Govan the *Equator*, *Erne*, and *Emulator*, steam trawlers, of 160 tons each, for the Great Northern Steamship Fishing Co., Hull. The vessels will be fitted with triple-expansion engines by Messrs. Muir & Houston, Kinning Park, Glasgow.

Lakonia.—On April 24th the London and Glasgow Engineering and Shipbuilding Co., Limited, launched at Govan a large steel screw-steamer for Messrs. Donaldson Brothers' Canadian cattle and cargo trade. This is the second steamer the firm has built for Messrs. Donaldson Brothers within the last two years. The dimensions of the vessel are:—401 ft. 9 in. by 49 ft. by 31 ft. moulded, with poop, bridge, upper bridge, and topgallant forecastle; she is classed 100 A1 three-deck rule at Lloyd's, and has Board of Trade passenger certificate. She is designed to carry over 7,000 tons deadweight, with a gross tonnage of about 4,700 tons, and is fitted with all the most modern appliances for handling cargo, &c., including 10 powerful steam winches. The upper deck throughout is fitted for cattle, and the main deck is arranged so that it also can be used for cattle. The steam winches are placed on platforms raised sufficiently high above the upper deck to keep them clear of the cattle. The after 'tween decks are divided into four refrigerating chambers for the carriage of Canadian dairy produce, frozen meat, &c. Besides having a double bottom on the cellular system, all fore and aft, there is a large chamber tank abaft the engine-room holding about 700 tons, and the fore and aft peaks are also fitted for water ballast. The captain, officers, and engineers are berthed on the bridge deck, also the saloon and passengers' accommodation. A new feature in this steamer is that all the crew, firemen, and cattlemen are berthed on the after part of bridge deck in sidehouses, which, besides being more comfortable quarters for the men, enables all the space on upper deck to be utilised for cattle, there being space for nearly 500 on this deck alone. Another special feature of the vessel is the ventilation, numerous cowls being distributed throughout the ship to thoroughly ventilate the holds and 'tween decks, and there is also a steam fan fitted for circulating the air in the 'tween decks, and everything has been arranged for passing the American and British regulations for carrying cattle and grain, including shifting boards, &c. The propelling machinery, which is supplied by the builders, consists of one set of triple-expansion engines having cylinders 28 in., 47 in., 76 in. diameter by 54 in. stroke. Steam is supplied by three single-ended boilers constructed for a working pressure of 170 lbs., and fitted with Howden's system of forced draught. A large auxiliary boiler is also fitted for supplying steam to winches, &c. As the vessel left the ways she was gracefully named *Lakonia* by Mrs. M'Leod, of Glasgow.

City of Aberdeen.—On April 26th there was launched at Aberdeen, for Captain Spence, of Aberdeen, a steel steam ketch, of about 162 tons gross, named the *City of Aberdeen*.

Amazonense.—On April 27th Messrs. David J. Dunlop & Co., engineers and shipbuilders, Inch Works, Port-Glasgow, launched from their yard at high water the above-named steel screw-steamer, of which the following are the principal particulars:—Length, from fore part of stem to aft part of post, 312 ft.; breadth, moulded, 40 ft. 9 in.; depth, moulded, to spar deck, 26 ft.; gross tonnage, about 2,500 tons. The vessel has been built under Lloyd's special survey to obtain their highest class as a "spar deck" steamer, and is to the order of Messrs. R. Singlehurst & Co., of Liverpool, for their well-known trade, her construction having been carefully supervised on behalf of the owners by Messrs. George Hepburn & Son, Liverpool, and Mr. Isaacs, owners' marine superintendent. The erections over the spar deck consist of a full poop, bridge, and topgallant forecastle; and over the bridge deck upper erections are fitted at forward and after ends, extending the full width of vessel, the former having a large steel deckhouse containing saloon finished in solid polished oak framing, with all the latest commodities and staterooms, bathrooms, pantries, lavatories, &c., for accommodation of first-class passengers. On top of this deckhouse is fitted a large teak house, in which commodious rooms are fitted for captain, and charthouse, over which again the flying bridge is built. The erections over after part of bridge deck, as well as the poop deck, have been adapted for locating the boats and life-saving appliances. Ample provision has been made for the accommodation of the engineers and officers, as well as the crew; and the outfit of the steamer includes Hall's patent stockless anchors for stowing in the hawse pipes, Emerson & Walker's steam windlass, warping capstan aft, and five steam winches by Dunlop, Bell & Co., 10 cargo derricks, and special portable derrick, and all gear for same, capable of handling 35 tons, at fore and main masts. The steering gear is a special feature in the vessel's fittings, this being furnished by Messrs. Fawcett, Preston & Co., of Liverpool, and of Oglethorpe's hydraulic type, with Hastie's screw gear on poop, Wailes, Dove & Co.'s patent bitumastic solution in bunkers and peaks, Bruce's outfit of compasses and nautical instruments, complete installation of electric light by Holmes, of Newcastle; in fact, all the most modern and approved appliances for the safe and speedy working of the vessel have been adopted. After the launch the vessel was moored alongside the builders' wharf to receive her machinery, &c., which consists of one set of triple-expansion engines, having cylinders 22½ in., 37 in., and 60 in. diameter, and 45 in. length of stroke, the steam for which is supplied by one large single-ended boiler 16 ft. 3 in. diameter by 11 ft. 6 in. long, all proportioned for a working pressure of 180 lbs. per square inch. The boiler is fitted with forced draught on Howden's latest principle. Boiler feed pumps are supplied by G. & J. Weir, Limited, while the evaporator, feed heater, feed water filter, and ballast pumps are all supplied by the Liverpool Engineering Co. In addition, a large marine type donkey-boiler is fitted to provide steam for deck machinery. The launch was witnessed by a large company of ladies and gentlemen. Amongst those present were Mr. Isaacs, Mr. George Hepburn, and Captain Hughes, representing the owners, and Mr. Dunlop the builders. The naming ceremony was most gracefully performed by Mrs. William Isaacs. The new steamer will be commanded by Captain Hughes, who has had long experience in the service of the owners.

Alabama.—On April 28th Messrs. Charles Connell & Co. launched at Whiteinch the steel screw-steamer *Alabama*, which they have built to the order of Messrs. Robert MacKill & Co., for the United Steamship Co., of Copenhagen. The dimensions of the vessel are:—Length, 375 ft.; breadth, 50 ft.; depth, 28 ft. 6 in., moulded, with a deadweight capacity of about 7,000 tons. She has been built to Lloyd's highest class, with a cellular double bottom right fore-and-aft for water ballast, and is fitted with all the latest appliances for the rapid and efficient working of ship and cargo. The engines, constructed by Messrs. David Rowan & Co., of Glasgow, are of the triple-expansion type, having cylinders 25 in., 41 in., and 67 in. by 48 in. stroke, with two single-ended boilers.

Saldanha da Gama.—On April 28th there was launched from Panmure Shipyard, Dundee, a screw-steamer for Brazilian owners, and intended for the cattle-carrying trade on the Amazon. She has been named *Saldanha da Gama*, and is 170 ft. long, 26 ft. 6 in. broad, and 12 ft. 6 in. deep, with a gross tonnage of 600 tons.

Cragoswald.—On April 29th Messrs. William Hamilton & Co. launched from their Glen Yard, Port-Glasgow, a steel screw-steamer, for Messrs. Lunn & Maccoy, Newcastle-on-Tyne, for the general and Eastern trade. The dimensions of the vessel are:—Length between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in., with poop, bridge, upper bridge, and topgallant forecastle; and she is classed at Lloyd's 100 A1. She is designed to carry over 5,400 tons deadweight on a comparatively light draught of water, with a net registered tonnage under 2,100, and a gross tonnage of 3,400. The propelling machinery, which is being supplied by Messrs. David Rowan & Co., of Glasgow, consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 66 in. diameter respectively, by 42 in. stroke. Steam is supplied by two large boilers constructed for a working pressure of 180 lbs. As the vessel left the ways she was named the *Cragoswald* by Miss Hettie Maccoy, of Newcastle.

Guatemala.—On April 29th Messrs. Caird & Co., shipbuilders, launched at Greenock the steel twin-screw steamer *Guatemala* for the Pacific Steam Navigation Co. The vessel, which is of 3,500 tons gross, is of the following dimensions:—359 ft. in length, 43 ft. broad, and 22 ft. 6 in. deep, and will be engined by the builders.

Tantallon Castle.—On May 6th there was launched by Messrs. John Scott & Co. at Abden Works, Kinghorn, the first of the two paddle steamers for the Galloway Saloon Steam Packet Co. The vessel is designed and constructed to obtain a No. 3 Board of Trade certificate (passenger), which enables her to sail between Leith and Dundee, or on to Berwick and Newcastle. Her dimensions are:—210 ft. long between perpendiculars by 25 ft. beam, and 55 ft. wide over sponsons, by 8 ft. 6 in. depth, moulded, to main deck and 16 ft. 6 in. to promenade deck. The promenade deck extends 145 ft. fore and aft by the full width of the vessel. Every part of this deck is available for passengers except the portion taken up with the two funnels and ticket office. There are no openings from end to end on this deck, the sponsons having been taken advantage of to contain the stairs (four in number) leading between the main and the promenade deck. The portion of the main deck abaft the machinery has been taken up with the first-class main saloon, which extends the full width of the vessel. The smoke-room is forward of engine and boiler space. Attention has been given to the dining accommodation, the first-class under the main saloon, and the second-class under smoke-room, each fitted with a large bar and pantry. Alongside of the engine and boiler casing on either side, and extending from front of main saloon to front of smoke-room, are covered-in alleways, which will prove a great boon to passengers in case of stormy weather, and will be sure to be taken advantage of. The main engines are of the diagonal compound surface-condensing of 1,800 I.H.P.; the boilers work under forced draught on the close-stokehole principle, and designed to propel the vessel at a mean speed of 17 knots. As the vessel left the ways for her native element she was gracefully christened the *Tantallon Castle* by Mrs. Aitken, wife of the chairman, and, as is usual with vessels built by John Scott & Co., she immediately steamed off on her preliminary trial trip.

Calchas.—On May 8th Messrs. Scott & Co. launched at Greenock the screw-steamer *Calchas*, for the Ocean Steamship Co., Liverpool. Dimensions:—Length, 441 ft.; breadth, 52 ft. 6 in.; depth, 30 ft. 3 in.: of 6,763 tons gross, with a carrying capacity of 8,200 tons. The builders will supply triple-expansion engines of 4,200 I.H.P.

Paris.—On May 9th the Irvine Shipbuilding and Engineering Co., Limited, launched from their yard at Irvine a steel screw-steamer of about 750 tons deadweight, to the order of Messrs. B. P. Hutchison, Glasgow. The vessel has been built to Lloyd's 100 A1 class under special survey, and has been specially designed to meet the requirements of the owners, Continental trade, her dimensions being 180 ft. between perpendiculars by 27 ft. 6 in., by 14 ft. moulded; water ballast is fitted in holds, and fore-and-after peak tanks, and the vessel is supplied with steam-steering gear, direct-acting steam windlass and capstan combined, and powerful deck machinery for the speedy handling of cargo. This vessel is a duplicate in design of the s.s. *Hector* built last year by the same firm for Messrs. Hutchison. The machinery and boilers are being supplied by Messrs. Hutson & Son, Limited, Kelvinhaugh, Glasgow. The vessel on leaving the ways was gracefully named *Paris* by Mrs. Gaff, Woodstow, Maxwell Park, Glasgow.

Bavarian.—On May 11th Messrs. William Denny & Brothers launched at Dumbarton a twin-screw steamer of 10,200 tons, for Messrs. James & A. Allan, of Glasgow. The vessel, which is by far the largest in the company's fleet, is 520 feet long over all, 59 ft. in beam, and 43 ft. deep. She has been designed to meet the latest requirements of the Allan Line's Canadian trade. The hull is built of steel to the requirements of the Board of Trade for foreign-going passenger steamers, and the construction and design have been under the special survey, and with the scantlings required by the British Corporation for their highest class. When completed, the vessel will have accommodation for about 162 first-class passengers in the fore-end of the bridge, and on the bridge deck, 136 second-class in after-part of bridge and on upper deck amidships, and 200 third class in upper deck aft. The engines and boilers are being supplied by Messrs. Denny & Co., and consists of two sets of triple-expansion engines, and a set of single-ended boilers. The vessel was named *Bavarian* by Mrs. Bryce Allan.

Taymouth.—On May 12th Messrs. Gourlay Brothers launched at Dundee the first of two steam trawlers which they have built for the Tay Trawling Co. The vessel, which is built to the highest class at Lloyd's, under special survey, is 105 ft. long, 20 ft. broad, 11 ft. deep, and her gross tonnage is 135 tons. The machinery consists of a set of triple-expansion engines and one large single-ended boiler. The vessel was christened *Taymouth* by Mrs. Robert Cook, wife of the managing director of the company.

Pervi.—On May 12th Messrs. Wm. Simons & Co., Limited, launched complete from their works at Renfrew the first of two powerful dredging vessels, which they have constructed to undertake extensive dredging operations in connection with the improvement of Port Arthur and Tallenwan. The vessel has been built under the direction of Mr. Totshyski, inspecting engineer, assisted by Mr. Johnson. The dredger, in addition to being provided with a chain of buckets for discharging into barges alongside, is fitted with a sand suction pump, also with a mud discharging pump; to which is attached fully 2,000 ft. of shore discharging pipes, carried on floating pontoons, having flexible joints. The vessel is capable of dredging and discharging 1,000 tons of spoil per hour, and of working to a depth of 40 ft. below the water level. Two pair of compound surface-condensing engines are fitted for propelling the vessel at a speed of seven knots per hour. It is constructed in accordance with the rules of Bureau Veritas for the highest class for a vessel of this type. Electric light installation is provided for working day and night. A repairing room is also fitted on board with turning lathe, drilling and planing machine, &c. As the vessel left the ways she was named *Pervi* by Mrs. Walter Brown, Monkdyke, Renfrew.

Kinfauns Castle.—On May 12th the Fairfield Shipbuilding and Engineering Co., Limited, Govan, Glasgow, launched the *Kinfauns Castle*. The vessel is built with a straight stem and elliptical stern, a very long forecastle, and a promenade deck and poop extending about four-fifths of the length of the vessel. Under the promenade deck is a central house 9 ft. high, leaving a passage at the ship's side. Eight ft. 6 in. above the promenade deck is a boat deck with deck-house, and on this deck provision is made for carrying the lifeboats. The vessel is built of steel throughout to the requirements of the Board of Trade for a foreign-going passenger steamer, also under special survey, and with scantlings, as required by Lloyd's latest rules for the 100 A1 class. A cellular double-bottom is fitted the full length of the ship, and the holds are subdivided into separate compartments by watertight bulkheads, which are arranged and constructed so as to meet the recommendations of the Bulkhead Committee, with a double collision bulkhead fitted forward. All the decks are plated and sheathed with teak. The *Kinfauns Castle* will have two large funnels, each 110 ft. long, and 15 ft. by 11 ft. diameter, and three raking-pole masts, fore-and-aft schooner-rigged. Her dimensions are as follows:—Length, over all, 532 ft. 3 in.; length on water line, 515 ft.; breadth, extreme, 59 ft. 3 in.; depth, moulded, 38 ft. 9 in. The gross tonnage is about 9,700 and the I.H.P. about 10,000. When completed the vessel will contain accommodation for about 300 first-class passengers, berthed amidships; 160 second-class, berthed aft; and about 200 third-class, berthed forward. The sanitary accommodation and lavatories throughout the vessel have received special consideration, and are of the latest and most approved description. The ventilation has been carefully studied, and a most complete system adopted. Electricity is brought to bear in ventilating the saloons, corridors, and sleeping cabins in between decks, by means of a large number of electric fans. A continuous water service will be supplied throughout the ship. A complete installation of electric light is being arranged on board, the generating plant consisting of three independent sets of engines and dynamos. Electric bells will be fitted to the sleeping cabins and saloons. A large refrigerating plant is also to be fitted on board, and specially insulated chambers will be provided for the supply of meat, fish, poultry, vegetables, milk, fruit, &c. The cargo hatches will be equipped with 9 steam winches for the rapid handling of cargo, an additional steam winch being also fitted for the purpose of hoisting the boats, of which sixteen are provided, in addition to a full outfit of life-saving appliances and all other details required by the Board of Trade Passengers Act. The steam steering engine is placed aft on the poop deck, enclosed in a house and controlled from the navigating bridge, also the reserve hand gear and steering wheels. A large steam windlass with frictional brakes and capstan will be fitted on the forecastle deck, adapted for the cables, which are 2⅞ in. in diameter. There are four heavy anchors made of nickel steel and of Hall's patent stockless pattern. Two powerful steam-warping capstans with separate engines are placed on the poop deck. Some idea of the dimensions of the ship may be gathered from the fact that a walk half-a-dozen times round the promenade deck means about a mile.

In order to minimise rolling, deep plate bilge keels are fitted, and these with the centre bar keel—having together a side area of 750 square feet—will ensure greater comfort for passengers by reducing very considerably the angle of roll in bad weather.

The propelling machinery consists of two sets of four-cylinder, four-crank quadruple-expansion engines, balanced on the Yarrow-Schlick-Tweedy system.

This type of machinery, with a boiler pressure of 210 lbs. per square inch, ensures great economy of fuel, combined with minimum vibration of the ship. The engines are designed to run at a high piston speed, with large bearing surfaces, and comparatively light reciprocating parts. The shafting is of Whitworth steel throughout, and the working parts are forged from ingot steel, the principal bolts being specially annealed. The main condensers of galvanised steel plate are elliptical in section. They are placed close to the ship's side, and do not form part of the framing of the engines. In this and several other respects the machinery compares favourably, as regards weight, with the type of engine usually fitted in mail steamers. The pistons are of Whitworth steel, and, to carry out the balancing of the engines as accurately as possible, they were turned down to the correct weight after the other reciprocating parts were finished and weighed. The propellers are of bronze with cast steel bosses. Every care has been taken to combine with the highest class of material and workmanship all details which experience has proved to be necessary to obtain freedom from breakdown on a long ocean run. Two powerful independent centrifugal pumping engines are fitted in the engine room, and are so arranged that both main condensers can be circulated by either pump in the event of a breakdown of the other. Each of these pumps has a special bilge suction connection, so that, in the event of a serious leak above the double bottom, both can be used for pumping out the ship. The discharges from these and all other pumps are below the water line, to avoid spray being carried into the stateroom side ports. Three large steam pumps are fitted specially for hot bath, cold bath, sanitary, and fire service purposes. The fire service mains from these pumps are carried right fore and aft on the weather deck, and also in the passenger 'tween decks, with connections for hose at the necessary points. Very special plant is provided, entirely in duplicate, for evaporation and distillation. The total output of pure cool drinking water from this installation is 13,000 gallons per day. Combined with the fresh-water supply throughout the ship there is a complete installation of filters of the Berkfeld type, which ensure absolute immunity not only from ordinary impurities held in suspension, but from disease organisms being carried by the water.

For the refrigeration of ship's provisions and the carrying of fruit or other cargo, a powerful duplex CO_2 machine is fitted in combination with six large insulated cold chambers. There are also larders, wine and mineral water coolers in every bar, and cooled water drinking fountains throughout the ship.

The electric light and power installation is on a considerable scale. In addition to nearly 1,000 lights in the ship, there are 26 motor-driven blowing and exhausting fans (20 of which are each capable of passing 3,400 cubic feet of air per minute) for sending air down to the engine-room and stokeholds, and for extracting vitiated air from the passenger 'tween decks. Electric lifts are employed for hoisting ashes in port when the hydro-pneumatic ejectors are not in use. Motors are also freely used throughout the ship for working roasting ovens, for knife cleaning, coffee grinding, hair brushing, &c. For signalling in fog an electrically controlled steam whistle is fitted, which is automatically sounded at the required intervals of time by a clock control. For communicating between the navigating bridge and the engine-room, and other parts of the ship, loud-speaking telephones are fitted. The attendance at the launch was exceptionally large. Lady Georgina Home-Drummond performed the launching ceremony.

Barrow Castle.—On May 13th the Ailsa Shipbuilding Co., Troon, launched from their yard a steel screw-steamer, which they have built for Messrs. Robert M'Cowen & Sons, Tralee, for-the general coasting trade. The dimensions are:—Length between perpendiculars, 145 ft.; breadth, moulded, 23 ft. 6 in.; depth, moulded, 11 ft.; and carrying capacity 400 tons. Compound engines with cylinders 18 in. and 38 in. by 27 in., are being supplied by Messrs. Dunsmuir & Jackson, Govan. The naming ceremony was performed by Mrs. Jackson, who named the vessel *Barrow Castle*.

Venture.—On May 15th the Caledon Shipbuilding and Engineering Co., Limited, Dundee, launched a steel twin-screw steamer to be employed in the oil trade on the Caspian Sea. Her dimensions are:—Length, 255 ft.; breadth, 32 ft.; depth, 18 ft.; carrying capacity, 1,500 tons. The vessel has been built to the order of Sir Christopher Furness, London and West Hartlepool, for Messrs. Alfred Stuart & Co., London, and has been named *Venture*.

Dundalk.—On May 16th there was launched by Messrs. A. & J. Inglis, at Pointhouse, on the Clyde, a twin-screw steamer for the Dundalk and Newry Steam Packet Co.'s Liverpool service. The vessel was named the *Dundalk* by Mrs. Brown, daughter of the chairman of the company.

Silvio.—On May 20th there was launched from the yard of the Campbeltown Shipbuilding Co. the second of two steel screw-steamers, built to the order of the Bristol Steam Navigation Co. The vessel, which is of 2,000 tons deadweight, and has been built to the highest class at Lloyd's, is intended for Continental trading. She will be engined on the Clyde. On leaving the ways the steamer was gracefully named *Silvio* by Mrs. Peter Mackay.

Duchess of Fife.—Lately there was launched from the works of the Clydebank Engineering & Shipbuilding Co., Clydebank, the paddle steamer *Duchess of Fife*, designed for the joint service of the London & South-Weston and London, Brighton & South Coast Railway Co.'s between Southampton and the Isle of Wight. The vessel is 215 ft. long, 26 ft. broad, and 10 ft. deep. The propelling machinery is of the compound-diagonal direct-acting type, with two cylindrical boilers, working at a steam pressure of 150 lb. per square inch. All the auxiliary machinery is of exceptional power, and of the most modern type. The launching ceremony was performed by Miss Brown, daughter of Mr. R. Brown, the marine superintendent of the joint companies at Portsmouth. The vessel will be placed on the summer excursion service immediately on delivery. She has been built to comply with Board of Trade requirements as regards hull, machinery and equipment.

Elba.—On May 24th Messrs. Ramage & Ferguson, Limited, Leith, launched a steel screw-steamer, built to the order of Messrs. James Currie & Co., Leith, for their general cargo trade. The principal dimensions of this vessel are:—Length, 225 ft. by 33 ft. 3 in. beam, by 16 ft. 11½ in. depth, moulded; and the engines are triple-expansion, with cylinders 18½ in., 30 in., and 49 in. diameter, by 33 in. stroke, steam being supplied from a large single-ended boiler, working up to 165 lbs. pressure. The steamer has been built to the highest class at Lloyd's and has all the most modern improvements for working cargo. On leaving the ways, the vessel was named *Elba* by Mrs. Crawford, 21, Stirling Road, Trinity; and subsequently the builders entertained a company to lunch, including Mr. James Currie, Mr. James Currie, jun., Mr. A. Currie, Mr. Crawford, and others, when the toasts usual on such occasions were duly proposed and honoured. This is the twelfth steamer launched by the same firm for Messrs. James Currie & Co.

LAUNCHES.—German.

Saxonia.—On April 19th there was launched by the Flensburg Shipbuilding Co. the s.s. *Saxonia*, a steel screw steamer of about 6,000 tons, built to the order of the Hamburg American Line. The vessel, which is constructed to German Lloyd's class 100 A1, is 414 ft. 6 in. long, 46 ft. 5 in. broad by 30 ft. 2½ in. depth, moulded, with long poop and topgallant forecastle. A full equipment is fitted of the most efficient machinery for a rapid loading and discharging of all descriptions of cargo. She is intended for the trial Hamburg-East-India. The accommodation for officers is placed in a deckhouse on top of poop, amidships. Her engines, of 1,800 H.P., will also be built by the Flensburg Shipbuilding Co. As the vessel left the ways she was named *Saxonia* by Miss Erna Lempelius.

Steel Lighter.—On April 20th a new steel lighter left the Flensburg Shipyard. The dimensions are:—Length, 84 ft.; beam, 21 ft.; depth, moulded, 8 ft. 6 in. The vessel is built on the self-trimming system patent of Mr. Bredsdorff, managing director of the Flensburg Shipbuilding Co. The advantages of ships built according to this system are that they take a full cargo of coals and grain without any trimming, and that it is impossible for the cargo to shift, which is of the greatest importance. The lighters are intended for trade between the new free port of Copenhagen and all Baltic ports. There are five other barges on this system under construction for the same company, Det Danske Damper og Lægter Co.

TRIAL TRIPS.

Seapoint.—On April 22nd the s.s. *Seapoint* proceeded down the Clyde for her trial trip. The *Seapoint* is a fine screw steamer of the raised quarter-deck type and constructed with the most recent improvements necessary for the modern coasting trade. She has been built by the well-known firm of S. McKnight & Co., Limited, of Ayr, for Messrs. Joseph Fisher & Sons, of Newry. The dimensions of the vessel are:—175 ft. by 26 ft. 6 in. by 13 ft. moulded, and she is capable of carrying considerably over 700 tons deadweight on a very small register, while at the same time her capacity is such as to enable the deadweight to be stowed at the rate of nearly 50 cubic feet to the ton. The *Seapoint* has been constructed to the highest class at Lloyd's under special survey. She has cellular double bottom for water ballast throughout the whole length of the hold, and her bottom generally is specially strong for loading aground. Powerful steam-steering gear is fitted on the bridge amidships, also powerful steam winches for the quick handling of cargo. She has a large rudder, and a special feature of the trial was the facility with which she was steered, this being a necessity for the owners' trade when passing up canals. On the measured mile at Skelmorlie six runs were taken, and a mean speed of 9·794 knots was attained, the vessel at the time being fully loaded and in seagoing trim. The machinery has been supplied by Messrs. McKie & Baxter, engineers, Govan, and has also been constructed under Lloyd's rules for the highest class. It consists of a set of compound surface condensing engines, cylinders 19 in. and 44 in. by 30 in. stroke, supplied with steam from an extra large horizontal return tube marine type boiler. The workmanship is of the highest class throughout and during the trial the machinery worked exceedingly satisfactorily. After completion of the speed &c., trials, the vessel proceeded on her maiden voyage to Newry.

Montfort.—On April 26th the s.s. *Montfort* built by Palmers Shipbuilding & Iron Co., Limited, to the order of Messrs. Elder, Dempster & Co., of Liverpool (of which we gave full particulars in our Launch columns, March issue, page 514), was taken to sea for her official steam trials; during which the engines worked in a highly satisfactory manner at 79 revolutions per minute, and a mean speed of 12·389 knots was attained on the measured mile.

Secunda.—On Wednesday, April 26th, the Flensburg Shipbuilding Co. sent out for trial trip the new steamer *Secunda*, which they have built for the Flensburger Dampfschifffahrts-Gesellschaft von 1869 (of which we gave particulars in our Launch columns, April issue, page 44). Her engines of 200 H.P. gave the vessel an average speed of 10·8 knots. Two large boilers working at a pressure of 105 lbs. gives the steam. After the trial the steamer proceeded to Blyth, where she will load her first cargo.

Airedale.—On April 26th the fine steel screw-steamer *Airedale*, built by Messrs. Wm. Gray & Co., Limited, to the order of the London & Northern Steamship Co., Limited, London (Messrs. Pyman Brothers, managers), left West Hartlepool for her trial trip. The *Airedale* is a first-class cargo vessel, built to Lloyd's highest class, and is of the following dimensions:—Length over all, 341 ft.; breadth, 47 ft.; depth, 24 ft. 10 in. The engines are of the Central Marine Engine Works usual triple-expansion type, having cylinders 24 in., 38 in. and 64 in. in diameter, with 42 in. piston stroke, and two large steel boilers working at a pressure of 170 lbs. per square inch. The vessel and her machinery have been built under the superintendence of Mr. Wm. Birchby, and that gentleman, together with Captain Murrell, from the shipyard, and Mr. W. C. Borrowman, from the engine works, was present at the trial, which was in every way satisfactory, the average speed being 10½ knots. After the trial, the vessel proceeded to Barry Dock to load for the River Plate.

Newholm.—On April 29th the s.s. *Newholm*, which has been built to the order of Messrs. J. J. & C. M. Forster, of Newcastle, by C. S. Swan & Hunter, Limited (of which we gave full particulars in our Launch columns, April issue, page 42), was taken out to sea for her trial trip. Everything worked with perfect smoothness, and a mean speed of 11¾ knots was attained on the measured mile, which was considered highly satisfactory. During construction the vessel has been under the supervision of Captain Sarah, the marine superintendent of the owners' and the machinery under that of Mr. J. R. Scott, their superintendent engineer.

Ravenshoe.—On May 1st the steel screw-steamer *Ravenshoe*, the first vessel completed by the Northumberland Shipbuilding Co., Limited, of Howdon-on-Tyne (of which we gave full particulars in our Launch columns, March issue, page 514), was taken to sea for her trial trip. This vessel is of a type specially designed for the Cardiff trade, with a view to saving trimming dues, and has been built for the Seville and United Kingdom Carrying Co., Limited, Mr. John Cory being the managing director. On the measured mile a speed of 11 knots per hour was attained, the engines working in a satisfactory manner.

Java.—On May 3rd the s.s. *Java*, built by Messrs. Ropner & Son, of Stockton-on-Tees, left for her official trial trip in the Tees Bay. This steamer is built on the three-decked rule, with full poop, very long bridge, and top-gallant forecastle. The saloon and cabins for the captain and officers are fitted in the poop, and the engineers in iron houses on the bridge deck. The vessel will carry about 3,000 tons of cargo on Lloyd's summer freeboard, on a light draught of water, having cellular bottom of ample capacity for water ballast. She is fitted with all the most recent appliances for the expeditious and economical loading and unloading of cargoes, and her general outfit is fully up to date. The engines are supplied by the well-known firm of Messrs. Blair & Co., Limited, Stockton, of about 1,250 I.H.P. The trial trip was very satisfactory in every respect, and, after the adjustment of compasses, the steamer proceeded on her run round to Cardiff, where she will load. She is owned by the Societa Anonima Ungherese di Armamento Marittimo Oriente, of Fiume, Austria, who were fully represented at the trial by Mr. Cosulich and Mr. Nicolich, whilst the builders were represented by Mr. Leonard Ropner.

Akebono.—On May 4th, the torpedo-boat destroyer *Akebono* (*Dawn*), just completed for the Imperial Japanese Government by Messrs. Yarrow & Co., Limited, of Poplar, went through her official trials at the mouth of the Thames. The trial consisted of a three-hours' continuous run, carrying a load of 35 tons, when a speed was obtained of 31·159 knots. This is the third destroyer, having a speed of over 31 knots, which this firm has constructed for the Japanese Government; and these vessels constitute the fastest group of destroyers yet possessed by any nation. The Japanese Government were represented by Constructor-Commander Kondo, and Constructor-Captain Kurobe.

Anversville.—On May 5th the fine twin-screw mail and passenger steamer *Anversville* built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, to the order of Messrs. Elder, Dempster & Co., of Liverpool, for the Compagnie Belge Maritime du Congo, of Antwerp, was taken out to sea for her official trials, under the command of Captain Acton Blake. This vessel will run in the Belgian Mail Line between Antwerp and the West Coast of Africa. Her dimensions are: Length, 383 ft.; beam, 46 ft.; depth, moulded, 25 ft. Exceptionally fine accommodation is provided for 108 first-class passengers in handsomely fitted state rooms, opening off a wide corridor amidships; which, being open to the front of poop, admits a current of air, which is so desirable in hot climates. The saloon is in a house on top of the bridge, so as to be well lighted and ventilated all round; the walls are panelled in marble, the tables arranged for seating small parties separately, and all very handsomely upholstered. The entrance lobby and ladies' lounge above are *en suite* with the saloon, and a spacious smoke-room is on top of shelter-deck. The second-class accommodation, for 70 passengers, is better than in most steamers, first-class, having spacious saloon, smoke-room, state-rooms and baths, well decorated and splendidly ventilated. The whole ship is lighted throughout with electric-light, and a powerful refrigerating machine, with large cooling chambers is, provided for the conveyance of fresh meat, provisions, &c. Twin-screw triple-expansion engines have been fitted by the Wallsend Slipway & Engineering Co., Limited, Newcastle-on-Tyne, having cylinders 21½ in., 35 in., 59 in. by 42 in. stroke, supplied with steam by four large boilers working at 180 lbs. pressure and fitted with Howden's system of forced draught. A small party of friends were on board during the trials, which passed off most successfully, a speed of 14 knots being easily attained.

Valetta.—On May 6th the screw steamer Valetta, built by Messrs. Murdoch and Murray, Port Glasgow, and engined by Messrs. Hall-Brown, Buttery and Co., Glasgow, to the order of Messrs. Gow, Harrison & Co., Glasgow (of which we gave full particulars in our Launch columns, April issue, page 43), went down the Clyde on trial. Six progressive runs were made on the measured mile at Skelmorlie. The vessel was fully loaded with 4,750 tons deadweight, and with this load on a mean of full speed runs made 10½ knots, and on a mean of runs reducing the revolutions by 12 per cent., she made a speed of 9½ knots. The machinery throughout the day worked without a hitch.

Rembrandt.—On May 8th the new steamer *Rembrandt* (of which we gave full particulars in our Launch columns, May issue, page 91), went down the river, and during the day ran her official trials in the Firth. Throughout the machinery worked smoothly and to the entire satisfaction of the owners' representatives, of whom there were on board—Mr. Heywood Melly, Captain Bird, Mr. Morrin, Mr. Thomson, and Mr. John Russell. A mean speed of 13½ knots was easily attained, which fully realised the expectations of the builders and owners. The vessel during the evening returned to Glasgow, where she will complete her loading for South American ports.

Loch Lintrathen.—On May 9th the steamship *Loch Lintrathen*, which has been built by the Tyne Iron Shipbuilding Co., Limited, Willington Quay-on-Tyne, to the order of the Dundee Loch Line Co., Limited, Dundee, (of which we gave full particulars in our Launch columns, May issue, page 88). Unfortunately, the weather was somewhat unpropitious, but the trial of both vessel and machinery proved in every way satisfactory.

John Coverdale.—On May 10th the large steel screw-steamer *John Coverdale*, built to the order of Messrs. John Coverdale & Son, by Messrs. William Gray & Co., Limited, of West Hartlepool (of which we gave full particulars in our launch columns, February issue, page 475), was taken for her trial trip, when a speed of 11¼ knots was averaged, everything working very satisfactorily. A capital luncheon was provided by the owners, to which ample justice was done, and at which the usual loyal and other complimentary toasts were proposed and suitably responded to. The owners were represented by Mr. Robert Coverdale (managing owner) and Mr. Jas. Airey (who has superintended the building of ship and machinery); the shipbuilders by Captain Murrell, and the engine works by Mr. W. C. Borrowman. After the trial the vessel proceeded to Barry Dock to load for Naples.

Archanda.—On May 12th the steel screw-steamer *Archanda*, built by Messrs, Craig, Taylor & Co., Thornaby-on-Tees, to the order of the Compania Naviera Vascongada, of Bilbao, (Mr. Felix de Abasolo, managing director), (of which we gave full particulars in our Launch columns, May issue, page 89), proceeded to sea for her trial trip, during which the engines worked without the slightest hitch, and gave every satisfaction. The vessel proceeded to the Tyne, under the command of Captain Urizar. The owners were represented by Mr. Jose A. de Mendiguren, who expressed himself as being highly pleased with both the ship and engines.

Tantallon Castle.—On May 15th the *Tantallon Castle*, recently launched at Kinghorn by Messrs. Scott & Co. (of which we give full particulars in our Launch columns), left Leith on her official trial trip. Running down the firth the weather was hazy, but a good run was got to near St. Abb's Head, when the vessel was turned for home. Altogether, however, the trials gave satisfaction to both builders and owners. The distance from the Bass Rock to the Heriot Buoy was done in 59 minutes bringing out a speed of 17½ knots; and from thence the journey to Leith was accomplished at a slightly greater speed. The trials lasted six hours.

an.—Lately there has been completed by Messrs. Rennold- Sons, South Shields, a new twin-screw steam tug, named *itan*, built to the order of the Compagnie Universelle du l Maritime de Suez, and is intended for service in the Suez l, of the following dimensions:—Length, 158 ft; breadth, ; depth moulded, 17 ft. She has been built of steel, r special survey at Lloyd's, and is classed 100 A1. The elling machinery, which is of 300 I.H.P., has been con- ted and fitted by the builders, and consists of two sets of -compound engines, each set having cylinders 20 in., 33 in., 4 in. diameter respectively, with a stroke of 33 in. The act imposed an exhaustive series of trials, which were ed out with success, guaranteed requirements being well led. The *Titan* has sailed for Port Said under the command aptain W. H. Thompson, of South Shields.

glo-Australian.—On May 17th the screw-steamer *Anglo- alian* recently launched from the shipbuilding works of rs. Short Brothers, to the order of the Nitrate Producers nship Co., Limited, London (of which we gave full par- ars in our Launch columns, May issue, page 88), went out rial with very satisfactory results. After adjusting com- s the vessel was taken a series of runs over the measured when a mean speed of 13½ knots was attained.

shman.—On May 19th the trial trip of the s.s. *Irishman* place and proved highly satisfactory, a speed of 10 knots attained. This vessel was recently launched by the e Shipbuilding and Engineering Co., Limited, for Messrs. Kennedy & Sons, Glasgow, and is specially designed for coasting and continental trade. Her dimensions are t. by 21 ft. 6 in. by 9 ft. 6 in. moulded, with a carrying city of 250 tons deadweight. The machinery, supplied by rs. Muir & Houston, Limited, Glasgow, is of the compound ce-condensing type, having cylinders 16 in. and 32 in. by stroke, the boiler working at 120 lbs. pressure.

arwick.—On Saturday, May 20th, the screw-steamer *rick*, built by the Blyth Shipbuilding Co., Limited, for rs. Atkinson Brothers, of Newcastle-on-Tyne, was taken to or her loaded trial trip. The dimensions of the vessel are:— th, 243 ft.; breadth, 36½ ft.; depth, 18 ft. 9 in. She has built to Lloyd's highest class, and is fitted with all modern machinery and appliances for the quick discharging of . The North-Eastern Marine Engineering Co., Limited, Wallsend, have supplied the engines, which are of riple-expansion type, having cylinders 18½ in., 30 in., and . by 33 in. stroke. Various runs were made over the ured mile, the performance of both ship and machinery g every satisfaction. During construction the hull and ies have been under the superintendence of Mr. James es, of Newcastle. After trial the vessel proceeded direct on oyage to Drontheim, under the command of Captain J. I. son.

rton.—On May 20th the s.s. *Barton*, built by Messrs. er & Son, of Stockton-on-Tees, to the order of Messrs. ster & Barraclough, West Hartlepool, made her official trip in the Tees Bay. This steamer is built to carry about tons on Lloyd's summer freeboard, and is fitted with builders' patent trunk, full poop, bridge, and topgallant astle. The steamer is fitted with 6 large steam winches, hich steam is supplied by a large multitubular donkey r, steam-steering gear, steam windlass, &c., her general being very complete, and fully up to present-day require- s. She is fitted with powerful triple-expansion engines by ell-known builders, Messrs. Blair & Co., Limited, of about I.H.P. The trial trip passed off very satisfactorily, there no hitch or drawback of any kind. The owners were sented by Mr. Ross, their superintendent engineer, under supervision the vessel has been built. After the adjust- of compasses, the steamer proceeded on her run round to iff, to load for Singapore.

antsobe.—On Saturday, May 20th, the fine steel screw- ner *Elantsobe*, built by Messrs. Wm. Gray & Co., Limited, Hartlepool, for Senor Ramon de la Sota, of Bilbao, was to sea for her trial trip. She is the sixth vessel built by Gray & Co., for Mr. Sota, and is a sister ship to the *ake*, a report of whose trial we gave in our magazine. vessel has been built to Lloyd's highest class, and her ipal dimensions are:—Length over all, 300 ft.; breadth, .; depth, 20 ft. 2½ in. Her engines are of the triple- nsion type, built at the Central Marine Engine Works of the shipbuilders, and have cylinders 23 in. 36½ in. and 62 in. diameter, with a piston stroke of 39 in., steam being provided by two large steel boilers working at a pressure of 160 lbs. per square inch. The owner was represented by Captain Ricardo Goicoechea and Captain Torres, and the trial was in every way satisfactory, the vessel on its conclusion at once proceeded to Bilbao to load.

Reviews.

A Catalogue.—Messrs. Babcock & Wilcox have issued a very interesting and copiously illustrated book about their patent Water-tube Boilers. It is to a certain extent a trade catalogue; but it is that and a good deal more. It is a valuable contribution to the literature on the vexed question of Scotch *v.* Water-tube Boilers. A long list of vessels of every type designed for every kind of employment, and already fitted with the Babcock boiler, is afforded. We see that several of the fleet of Messrs. Thos. Wilson & Sons, of Hull, certain "turret" ships in the Newcastle and St. Lawrence trade, and ocean-tugs hailing from the Thames are all fitted with this type of boiler on this side of the Atlantic. On the other side, however, the idea has been much more fully developed. Many important vessels trading on the American lakes and a goodly number of the warships which constitute the new American Navy are so fitted. Then, as regards our own Royal Navy, we have the experience with H.M. torpedo-gunboat *Sheldrake*, whose original steam generators have been replaced by an experimental set of the Babcock boilers. This vessel is, naturally under the circumstances, being subjected to a prolonged and exhaustive series of experiments by the Admiralty, and so far the installation has given the greatest satisfaction.

The volume before us contains a reprint of Mr. A. E. Seaton's paper, read in 1897 at the Institution of Civil Engineers' Conference, on "The Use of Water-tube Boilers in the Mercantile Marine." The managing director of so important a shipbuilding and engineering establishment as that of Messrs. Earle's, of Hull, is entitled to speak with authority on such a subject. He seems to think that for high-speed passenger ships and for vessels of the passenger and cargo class these boilers offer great advantages, owing to the saving which they offer in weight, and to the rapidity with which steam can be raised by them—this latter quality being, of course, especially valuable in the case of cross-Channel boats. In a less degree is the advantage of the water-tube boiler apparent in the case of the ordinary tramp cargo boats. But even here a saving of weight in the machinery department—combined with the facility of repair which characterises the water-tube type—has its great recommendations. Two tables are appended to this paper.

The first of these shows the weights, &c., of boiler installations for a passenger steamer whose I.H.P. is 10,000, according as ordinary Scotch (with various draughts), Belleville, Thornycroft, Babcock & Wilcox, or Seaton generators are fitted.

The other table tells of the actual weights and other characteristics of the boilers actually fitted on the Babcock and on the Scotch principle to certain similar ships within a recent period by Messrs. Earle's. Much instruction can be gathered from the study of these tables.

The book contains many illustrations of boilers of the Babcock type and of vessels in which they have been fitted. It also contains much information as to the advantages of such installations, and as to the method of fitting and of working and managing these boilers.

Full descriptions of tests made with the Babcock boilers under stringent conditions both by the American Navy Department and by the British Admiralty are also afforded. We can confidently recommend the perusal of this volume to all who are interested in the practical solution of this great question between the two opposing camps which support the Scotch and the water-tube boiler respectively.

The Sinking of the Merrimac, by Naval Constructor Hobson, U.S.N. London: T. Fisher Unwin, 1899, price 7s. 6d. nett.

Lieutenant Hobson has provided us with a substantial and complete record of the operation with which he was so intimately connected, and which was the one dramatic episode in the recent Hispano-American War. There is much in the volume for us to learn from, much that we can admire, much that will give us food for reflection. We feel that we are taught something of the realities and sufferings of war, and of the causes which led to the destruction of Spanish rule in Cuba from the volume before us. Whatever may have been done with, or to, Lieut. Hobson after his return to his native shores, we do not know. What the newspapers over there said, is here no business of ours. All we can do is to take the man as we find him. In the pages of his book he appears as a modest, thoughtful, and observant man. One, in fact, of the class of men whose self-denial and patriotism acting upon a mind and a physique trained in good schools, abounded in the American forces and so made it easy for good officers to wipe out an inferior enemy.

The marine engineer will be interested especially in the earlier part of the volume. We are told how the obstruction of the Santiago channel by the sinking in it of a big steam collier was determined upon. We learn how, when the *Merrimac* was chosen for the sacrifice, which makes her famous, her officers were found at mess and were naturally incredulous at the statement that that night she was to be sunk under the guns of the enemy's fleet. The discussion of the best mode of securing her speedy foundering at the proper moment is instructive. Three suggestions seem to have been made. The first was the boldest. It was no other than to loosen a plate in each compartment of the ship by cutting off the rivet heads, and to leave nothing to keep the skin in position but the external pressure of the water. At the right time, an explosion capable of overcoming this external resistance was to be provided. This plan, however, had to be discarded because of the length of time which the rivet-cutting would necessarily occupy. Then were considered the relative merits of internal and external explosions for the same purpose. Eventually the laying of internal torpedoes, to be actuated by a battery, was decided upon. The work of stripping the ship, and of preparing her for the purpose for which she was selected, however, took longer than was anticipated, and the stripping, if not complete in every detail, was sufficient to throw great difficulties in the way of those who were to risk their lives in the ship. Too much time was lost, and after the volunteers had actually started upon their perilous mission, they were recalled by signal. We can well believe that a severe reaction followed, and that the twenty-four hours that intervened before the attempt could be renewed were trying indeed to those concerned. When at last the rush was made the attempt failed in so far as the channel was not blocked. Two causes contributed to this result. One was that the fire of the Spaniards cut away the steering chains, the other was the slowness with which the ship actually went down, in spite of all that those on board—aided by the fire of the enemy—could do. The *Merrimac* was carried by the tide down, instead of across, the channel. The chagrin of the Lieutenant as he with his handful of men clung through the summer night to a floating raft attached to the wreck can well be imagined; as, indeed, can be his later satisfaction when he found- on knowledge acquired in his prison—that if he had succeeded in his object of blocking the channel, he would have debarred his country's arms from the victory which they finally and fairly one.

Of the incredulity of the Spaniards—who by their own cross fire had suffered losses which they attributed to the guns of the *Merrimac*—as to the unarmed and almost unmanned condition of the poor old collier, we need not here do more than refer. As to the author's experience in prison we may leave our readers to learn for themselves from the writer's own pages. But we must mention the courtesy with which the gentlemen of Spain treated their captives. Yet at the same time we are afforded indications of the temper which has caused the Spaniard to glide so rapidly down the scale of nations; cruelty, and what is almost worse than cruelty—want of thought—are his characteristics. One's blood boils when one reads of the torture of the little black dog, of the ribaldry of the Spanish soldiery, who enjoyed its agonies, and of the astonishment of the Spanish officers at Lieutenant Hobson's vigorous protest against the outrage. This little touch of kindness to animals marks the Anglo-Saxon and the brave man, and stands in strong contrast to the external polish and formalism of the others, however kind they might have been to him. A vast amount as to the respective characteristics of the combatant nations may be gleaned from the book, and our respect for our sister nation will be largely increased by its perusal. We may add that the volume is copiously and beautifully illustrated. Those who read it will rise from the study with a respect for its author which the newspaper reports of his prowess could not give. His boldness was that of the enduring kind and had its source not in constitutio or in martial training but in conviction and intelligence.

The Naval Annual, edited by the Hon. T. A. Brassey. Portsmouth: J. Griffin & Co., 1899.

The thirteenth issue of this standard publication gains unwonted interest for more reasons than one. Most intelligen people are aware of the costly rivalry that has set in betwee the great Powers in the matter of comparative naval strength Such persons are generally anxious that the enormous interes that England holds in the maintenance of peace with honou should be conserved. Yet at the same time they are, as pruden persons, greatly concerned at the strong upward tendency displayed by successive Budgets. To "Brassey" they turn in th knowledge that there they will find a calm and accurate statement of the present position and future prospects of foreig navies and also a dispassionate review of our Navy's ability, a regards both *materiel* and *personnel*, to do its duty.

From the data here appended it would appear that at the end of the year 1899 the strength of England, as compared with that of the next two most important maritime Powers, will be:—

	England.	France.	Russia.
First-class	23	9	6
Second-class	11	9	9
Third-class	12	15	3
Totals	46	33	18

This is completed vessels. But regarding vessels projected, as well as those actually completed, the numbers are:—

	Battleships.	Coastguard ships.	Cruisers.	Torpedo gunboats.
Great Britain ..	57	23	137	34
France	36	16	52	21
Russia	21	16	28	9
Germany	16	19	24	4
Italy	14	3	21	17
United States ..	13	10	20	—
Japan	7	1	18	—

The writer in the annual seems satisfied with the table as i stands—especially as regards battleships. We are, howeve ourselves doubtful as to whether too many obsolete ships do n appear in the effective list. All navies must contain vesse that are growing old. But an old navy like ours must contai a fuller proportion than those of younger maritime Powers.

There is another matter, however, which makes the iss under review attractive. It is the full account which it gives the recent naval operations between Spain and America. Th interesting account of this war is illustrated by some excellen maps and charts. Another historical question is dealt with i the chapter by an anonymous author—the gunboat operation on the Nile during the recent Soudan campaign. The mention of anonymous contributions leads us to remark on another opportune chapter, of the name of the writer of which no mention is made. This is on the subject of British fortification; what we ought to fortify and to what extent. This subject was dealt with two years ago by no less an authority than Sir George Clarke and some little apology is made for reopening the subject. The recrudescence of what the writer of the chapter calls, somewhat contemptously, the "bricklaying" school has made further discussion desirable. Indeed one of the lessons of the Spanish-American war—as shown by the letters of Captain Mahan himself—was that the timidity, perhaps, not unnatural under the circumstances, of the coast dwellers at home is a factor with which naval authorities must be prepared to reckon, and is one which may hamper their movements at a critical moment when a chance shows itself for a dash upon the enemy.

The *Annual* opens with the usual introductory chapter on the "State of the Navy" from the pen of Lord Brassey. After reviewing the naval expenditure—current and recent—he sums up by saying that the British Navy is "assuredly not falling behind." Turning then to the question of manning, he holds, as he has long held, that the question of Naval Reserves is one that demands the most earnest consideration. He believes that a scheme for training boys for the Navy is essential. What form that scheme should take he is not prepared to say, but he in dicates that some modification of that propounded by the Navy League is most likely to meet the case. He, however, criticises that scheme as it stands, on the ground that it should never pay the shipowner for what he does by giving his support to the plan. In reviewing the question of shipbuilding at home and abroad, Lord Brassey, as usual, pleads for restriction of dimensions. Amongst battleships—whilst he admires the qualities of the *Majestic*—he pleads for the continued representation of the *Canopus* class. So he reiterates his belief that the *Powerful* and *Terrible* are beyond the legitimate displacement of any cruisers. But at the same time he is characteristically fair. The boldness which induced the designer to associate a practically new type of steam-generator with the largest engine ever put into a warship is fully recognised. He asserts, too, that the difficulties which were only to be expected under the circumstances with the machinery of these vessels has now been entirely overcome. Further, in relation to the question of size he notices the comparisons which have been made—to the disparagement of our naval ships—between war vessels built at Elswick and those designed by Sir William White. He emphasises the point —which should have been sufficiently apparent—that the greater displacement of the latter vessels gives them substantial advantages in directions which in the British Navy, at least, are of essential importance. He traces out, too, how from the lessons first taught at the Yaloo we are being shown that protection at the waterline is not the only essential in a warship, and that we are giving the superstructure of our new cruisers greater protection.

One of the lessons of the operations last year seems to have been the comparative inutility of the torpedo, and accordingly it seems likely that in the future these weapons will not be carried in any but torpedo craft. The same experience also shows the value of the mercantile armed cruiser. Immense benefit was derived by the United States from the assistance of the vessels of the American Line, though it is suggested that full use of their capabilities was not made. In this connection a point, which needs some qualification, is made against the auxiliary cruiser. It is stated that "vessels of this class [referring to the *St. Louis* at page 170] carrying 200 lbs. of steam in cylinders 14 ft. above the water-line are clearly unsuited for regular fighting purposes." We are not in a position to check the accuracy of this statement as to the level of the cylinders of the *St. Louis*. But we do know that the weakness here suggested does not infect all the auxiliary armed cruisers retained by the British Government; for the *Teutonic* and *Majestic* at least have the top of their cylinders below the water-line, and we believe that the same might be said of the *Lucania* and *Campania*. But the value of these auxiliaries in spite of the alleged weakness referred to is strongly insisted on. "The *St. Louis*," it is said, "went to sea with one quarter of her displacement in coal, and for six weeks never took on board any coal, water, or provisions. The publicists who have dwelt on the injury to Great Britain due to the abandonment of privateering may perhaps be induced to reconsider their position. For operations against commerce such vessels as the *St. Louis* and *St. Paul* in capable hands are necessarily formidable." The auxiliary armed-cruiser idea apparently recommended itself—at least in theory—to the Spanish also. They purchased from the Hamburg-American Line the *Normannia* and the *Columbia*, and the *Havel* from the North German Lloyd Co., not, as the *Annual* tells us, from the Hamburg Co. But they never had the energy to fit the vessels out.

The discussions as regards the further use of nickel steel, of the advantages of the triple-screw and of the turbine engine, are the main points in Mr. Dunell's most valuable contribution to the history of the year. The use of nickel, though much to be recommended, seems practically debarred by its high cost. The triple-screw has found a warm supporter in Commodore Melville, of the United States Navy, even though our own Admiralty seems to find good grounds for deferring adhesion to it. The present authorities are responsible for the universal adoption of the twin-screw in the Royal Navy, and thus should be assumed to look with *a priori* kindliness on the triple principle. We may justifiably assume that they have the best of good reasons for not doing so. The discussion of the turbine engine leads to a remark upon the importance of an absence of vibration in machinery, and we note that in another part of the same chapter the Yarrow-Tweedie-Schlick system of balancing is referred to. Attention is called to the serious demands now made by auxiliary machinery on the coal supply of warships, and a suggestion thrown out that economy may be effected by the use of electricity for all auxiliary purposes—cables being led from a central generating station. The danger arising from cut steam-pipes in action is alluded to, and the advantage of cables insisted upon, since no danger is caused by the fracture, and repairs are more easily and quickly effected. The famous run of the U.S.N. battleship *Oregon* is alluded to as a triumph for the naval engineer. It is a triumph of a humdrum kind perhaps, but it is this mastery of routine duties and attention to detail which lays the necessary foundation of success in emergency.

The whole volume—as will be seen from our imperfect review—is worthy of the reputation of its predecessors, and of Lord Brassey.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from April 13th to May 9th 1899.

7531 D. B. Devore. Feeders for boiler furnaces.
7534 H. F. Smyth. Screw propellers.
7537 W. & T. D. Bayliff and B. Draper. Packing valves.
7544 F. G. Wright. Flanging metal plates.
7547 J. T. Pearson. Marine signalling apparatus.
7566 A. Bauer. Speed regulators for engines.
7598 W. Boby and C. B. Wigg. Pressure-regulating valves.
7623 E. Seymour. Engines.
7634 J. M. Lo'vold. Steering gear for vessels.
7636 D. Enock. Water-tube boilers.
7645 B. and H. Lee. Lubricators
7677 R. Macgregor. Closing water-tight doors.
7687 F. Watts and F. Willmott. Saving life at sea.
7702 W. von Oechelhaeuser. Double-piston twin-motor.
7735 H. B. & J. S. Watson and T. C. Billetop. High-speed engines.
7742 W. Evans. Governors for marine engines.
7756 Sir W. Arrol and T. B. Murray. Dynamos.
7762 O. Howl and W. J. Tranter. Steam boilers.
7767 G. R. Brace. Cleats for cargo battens.
7768 G. R. Brace. Stanchions for cattle fittings.
7777 M. H. Bowden. Ships' life-saving apparatus.
7778 C. S. Snell. Utilising wave motion.
7810 J. A. & S. Fletcher. Water gauges.
7818 J. D. Young. Manœuvring steam ships.
7823 C. T. B. Saugster. Internal combustion engines.
7835 J. Hardill. Compound steam engines.
7847 A. W. Cooper and J. S. Greig. Steam generator.
7848 G. Woertge. Lubricating cranks.
7851 S. & H. Turner. Cable clips for haulage.
7872 F. A. Spangenberg. Increasing the pressure of steam in engines.
7873 H. E. Newton. (C. C. Worthington, United States.) Steam engines.
7876 M. Honnicke. Steamboat driving mechanism.
7879 C. W. Thompson. Propelling boats.
7893 L. Pszczolka. Reducing pig iron into "Bessemer" steel.
7900 W. Thomas. Ships' compasses.
7931 C. Bullock. Apparatus for steering torpedoes.
7940 J. Taylor. Propellers.
7958 A. J. Boult. (L. Dolone, France.) Insubmergible vessels.
7968 A. Maton. Composition for hardening steel.
7973 A. Goodwin. Duplex pumps.
7990 T. Sugden. Water-tube steam generators.
7993 A. C. Buck. Nautical instruments.
8020 F. Offen. Reversing gear for engines, &c.
8029 W. F. Foord and W. J. Penniall. Life-saving rafts.
8030 E. E. Marchand. Centrifugal pumps.
8085 J. Shepherd. Steering gear for fishing boats.
8185 T. Christie. Ships' berths.
8186 H. Norris. Tubes for boilers.
8226 H. Wolters. Furnace for production of boiler tubes.
8233 E. & A. W. Bennis. Steam boiler furnaces.
8238 J. Calcaterra and H. Willis. Anti-friction bearings.
8271 A. Buchan. Vessel-building uprights.
8345 S. Cowper-Coles. Rendering wood fireproof.
8359 E. Reilly. Packing for piston-rods.
8396 W. R. Renshaw. Stuffing-boxes and glands.
8418 H. N. Bickerton and H. W. Bradley. Piston for pumps
8420 G. Duncan and A. G. Ramage. Punching holes in steel.
8433 A. Lambie. Building ships.

8446 C. H. Berry and J. Snowdon, jun. Lubricating apparatus.
8466 H. Blessinger. Water-tube boilers.
8504 A. May. Boat-lowering apparatus, &c.
8509 A. F. Ball. Lanterns for ships' lights.
8514 F. H. Briggs. Couplings of steam pipes.
8520 W. Fairweather. (C. Thomson, Canada.) Closing water-tight doors.
8521 R. C. Sayer. Packing cylinder pistons.
8530 R. Schwartzkopff. Safety gauge cock for boilers.
8552 N. Popoff. Steam engine governing apparatus.
8554 H. Siebert. Tubular boilers.
8555 M. F. Mulready. Steam engines.
8573 L. P. Hanson. Marine engine steam regulator.
8583 A. Robertson. Ships' side-lights.
8585 K. D. Noble. Steam boiler feed regulators.
8588 H. MacColl. Bearing for stern of steam vessels.
8602 D. Harvey. Glands for packing piston-rods.
8605 F. S. Dudgeon. (F. von Kodolitsch, Austria-Hungary.) Riveting machine.
8644 L. S. Thompson. Transmitting orders on ships.
8668 G. F. Jarvis. Tubulous boilers.
8677 H. H. Lake. (J. d'Este, United States.) Pressure-regulating valve.
8689 J. C. Fell. (C. B. Cottrell & Sons Co., United States) Mechanical movements.
8698 R. W. Thompson. Ventilating steamships.
8700 R. F. Hall and T. B. Sharp. Manufacture of steel.
8732 G. Wiltshire. Lubricator.
8735 J. C. Dobbie. Steam engine indicators.
8744 P. Barry. Repairing fractured screw shafts at sea.
8760 W. V. Chisholm, R. D. Kirk, and W. Chisholm. Wrenches.
8784 H. B. & J. S. Watson, and T. C. Billetop. Governing high-revolution engines.
8786 W. P. Thompson. (C. Bonafede, Italy.) Funnels.
8822 J. Clark. Screw propeller.
8831 A. G. New. Internal combustion engines.
8854 H. H. Benn. Friction clutch couplings.
8855 R. C. Ayton. Internal combustion engines.
8856 E. W. Koster. Valve mechanism for pumps.
8862 S. Deards. Cowls.
8925 J. C. Martin. Construction of boats.
8927 N. McE. S. Douglas. Stopping leaks in ships.
8939 H. Stevenson. Composition of asbestos.
8962 E. Simmons. Injecting air for boilers.
8965 W. J. Murphy. Cable gear.
8969 J. G. Statier. Steering gear.
8985 J. Shaw. Valves for steam water.
8992 J. W. Klahn. Disengaging boats.
9020 R. R. Bevis, jun., and J. H. Gibson. Valves.
9039 H. A. Thirion. Centrifugal pumps.
9043 Dr. A. E. Brechot. Torpedo boats.
9057 E. J. M. La Combe. Protecting tubes of steam generators.
9068 J. Salkeld. Governing steam engines.
9079 G. M. A. Coovels. Regulating water-level in boilers.
9098 A. J. Boult. (J. P. Harrington, United States.) Making crank shafts.
9119 J. Jackson. Reversible rotary steam engines.
9138 L. Schreider and L. Gordon. Life-saving raft.
9161 H. J. Beswick. Ships' tell-tale telegraphic apparatus.
9171 H. E. Julyan. Preserving ships' bottoms.
9185 J. W. K. Leiper. Reducing temperature in vessels.
9195 J. Meek. Cat for dropping ships' anchors.
9206 S. R. Smith. Brakes for marine vessels.
9222 H. A. Maurer. Marine propulsion apparatus.
9236 E. T. Bunje. Ground tackle for buoys.
9239 H. J. Kimman and E. N. Hurley. Direct-acting engines.
9241 J. Brons. Rotary engines.
9242 G. Tabourin. Hydraulic propulsion of ships.
9281 G. R. Palmer. Steering and stopping ships.
9284 W. H. Clarke. Bearings for high-speed shafts.
9286 C. R. Davidson. Rudder heads for vessels.
9288 W. Jones and W. Cook. Launching ships' boats.
9309 J. Duthie. Combined mechanical riveters.
9310 A. W. Broughton. Lubricating pistons.
9313 W. Schmidt. Packing for piston valves.
9315 J. T. Armstrong and A. Orling. Steering torpedoes.
9316 C. Völker and C. Stahl. Rotary twin engine.
9330 J. C. Howell, T. Humpage, and H. I. Jacques. Capstans.
9345 W. T. Carter, J. A. Dawson, and T. Gray. Reversing gear.
9347 W. F. Fair. Rowing-boats.
9359 W. Wagstaff. Steam boilers.
9369 A. Bever. High-speed engines.
9379 G. Green. Feed-water heaters.
9445 O. O. Domon. Propulsion of ships.
9458 H. Wood. Manufacture of rivets.
9557 S. C. Paul. Anchors.
9590 E. J. Fry. Steam boiler furnaces.
9592 F. Barber. Lubricators.
9614 C. H. Benton. High-speed steam engines.
9628 T. and G. Baxendale and J. Gent. Driving mechanism for cranes.
9629 G. Betscher. Rotary steam engine.
9646 H. Taylor. Steam boilers.
9709 E. Dixon and E. Howl. Steam boiler furnaces.
9715 H. de Garrs and W. H. Allen. Fog-signal lights at sea.
9719 A. G. Brookes. (F. A. Littlefield, United States.) Valves.
9731 W. P. McKinley. Stuffing-boxes.
9732 W. Penman. Boilers for steam engines.
9738 J. W. Powers. Steam engines.
9769 R. Haddan. (J. Boyer, United States) Riveting apparatus.

Terek.—On May 24th this vessel was launched by Sir James Laing & Sons, Limited, at their works, Deptford Yard, Sunderland. She is the first of three steamers being built by that firm to the order of Messrs. Lane & Macandrew, of London, on behalf of Messrs. La Societe Commerciale et Industriale de la Naphte Caspienne et de la mer Noire, of Paris, and is especially designed for the carriage of oil in bulk. This vessel and her sister-ships are being constructed under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and are to obtain Lloyd's 100 A1 and the highest class of Bureau Veritas, to conform with the Suez Canal regulations for oil steamers. The principal dimensions are; 325 ft. by 45 ft. by 29½ ft. depth, moulded, and the engines, constructed by Messrs. George Clark, Sunderland, have cylinders 24½ in., 40 in., and 66 in. diameters respectively, with a stroke of 45 in., taking steam from two large single-ended boilers working at 180 lbs. pressure. Electric light is fitted throughout the vessel, and the pumping installations are especially handy and powerful, and is capable of dealing with oil cargoes with great rapidity.

Celtic Princess.—On May 24th there was launched from the shipyard of Messrs. Robert Thompson & Sons a finely-modelled first-class cargo and cattle steamer for Messrs. R. Hughes-Jones & Co., of Liverpool. Her dimensions are:—Length over all, 347 ft.; breadth, 46 ft 2 in.; depth, moulded, 28 ft. 6 in.; to carry about 5,600 tons deadweight on a light draught, and will on completion have Lloyd's 100 A1 class. She is constructed with poop aft, long bridge amidships, and topgallant forecastle, the poop and bridge being for light cargoes if required. There are five holds with large hatchways and powerful steam winches, also double derricks to each for the rapid loading and discharging of cargo. The accommodation for captain, officers, and engineers is placed amidships in large and spacious houses on top of bridge deck, the saloon and captain's rooms being neatly fitted up in different shades of oak, the crew and petty officers being berthed in forecastle. The water-ballast arrangement is on the cellular principle, with the addition of peak tanks, and is sub-divided both thwartships and longitudinally for trimming purposes, special attention being paid in this instance to have the tail-end shaft very short, so as to lessen the risk of breakage when crossing the Atlantic in ballast. The engines having cylinders 24 in., 39 in., 64 in., with 42 in. stroke, with very large boilers, are by the North Eastern Marine Engineering Co., of Sunderland. As the vessel left the ways she was gracefully christened *Celtic Princess* by Mrs. R. Hughes-Jones, wife of the managing owner.

The new Swansea dry dock which was opened lately, has an extreme length of 455 ft., and a width of 116 ft. between copings. The entrance is 60 ft. wide, and the depth of water on sill is 15 ft. at ordinary neap tides and 23 ft. at spring tides. The water will be pumped out by two powerful centrifugal pumps, 36 in. in diameter, capable of discharging 420,000 cubic feet of water per hour, and these pumps can empty the dock in about two hours at spring tide and an hour and a-half at neaps.

THE NEW YORK
PUBLIC LIBRARY
ASTOR, LENOX AND
TILDEN FOUNDATIONS

The Marine Engineer.

LONDON, JULY 1, 1899.

SHIPPERS and steamship owners have particular interests in the competition of colonial or foreign coalfields with our own supply. Of foreign supplies those of Pennsylvania, Russia, China, and Japan are at present most prominent; and of colonial fields those in South Africa—which are estimated to extend over 56,000 square miles in Cape Colony, the Orange Free State, the Transvaal, Natal, and Basutoland—with those of New South Wales and India, are the most important. The export coal trade is very sensitive as to rumours of such colonial or foreign competition, but weight for weight and calorific value with minimum of ash there is as yet little direct competition with our best northern and Welsh coals, especially for the marine service. A special commissioner has been appointed by the Cape Government to report on the South African coalfields, which he has reported are of vast extent, and as to their relative value for marine purposes in competition with British exports. Indwe coal, the best in the colony, with Stormberg next, he reports to be a valuable fuel for any purpose so long as it does not come into serious competition with a better article. The percentage of ash is, however, about 20 to 30 per cent., and the volatile constituents are also about 30 per cent., which must much reduce the value of this coal for steam-raising purposes where excess of ash is a nuisance and liable to choke the fires. It is estimated that one and half ton of such coal would be necessary to give the same evaporation as one ton of Welsh; and in the marine or naval services the extra weight to be carried and the tendency that the rate of evaporation for a given grate-area would be much diminished as compared with Welsh or hard steam coal, is not likely to render such colonial coal of service in any lines where speed is a desideratum, or when net-paying freight is desired to be of the largest proportion. Special grates with rocking fire-bars have been used on the eastern railways to enable this fuel to be used locally, and it is at least comforting to know that for many purposes the drain on our own coalfields may be relieved by such large stores of coal in our own colonies.

WATER-TUBE boilers are at last making their mark in steamers for passenger-carrying only. The first set of water-tube boilers passed by the Board of Trade for service in a purely passenger-carrying steamer was, we believe, the case of the *Meg Merrilees*, belonging to the Caledonian Steam Packet Co., about June last year. The special type of steam-generator in this case was the Haythorn water-tube boiler. We now note that boilers of the same type have been applied to a South of England pleasure steamer, the *Lorna Doone*, added by purchase by the Isle of Wight Royal Mail Steam Packet Co. to its existing fleet of steamers. The *Lorna Doone* was built in 1891 by a Glasgow firm, Messrs. Napier, Shanks & Bell, and engined by Messrs. D. Rowan & Son, of the same city, her gross tonnage being 427 tons. The old boilers were replaced after her last season's service by water-tube boilers, and with radical improvements to the engines, under the direction of Mr. C. W. Murray, M.I.N.A. The new boilers are characterised by a second combustion-chamber just below the main body of the tubes, and they serve to utilise a large proportion of the heat of the gases of combustion before they reach the base of the chimney. The heating surface of the new boilers is about double that of the boilers they displace, and the fire-grate is considerably increased in area. The second combustion-chambers also prevent the possibility of cinders or soot particles finding their way to the funnel, a great boon in a passenger steamer. The *Lorna Doone*, with her new equipment, has just run a trial trip with a large party of guests on board, when it was found that the boilers provided an ample supply of steam, and the combustion appeared perfect, there being an entire absence of flaming in the funnels. So far, therefore, the application of water-tube boilers—of which in this vessel there are three, two forward and one aft, with the stokehold between—has proved eminently satisfactory both to the crew and the passengers; and it would appear that the water-tube boiler as a type is every day increasing its field of application and usefulness, and appears as if it had come to stay. The crucial test of this type of boilers can, however, only be settled by lapse of time as regards their relative durability and ease of handling in regular work.

WE think it would be well if our Admiralty were to reconsider their present predilection for the Belleville type of water-tube boiler. No doubt, from the early date of introduction of this boiler, it has a longer record than others as regards practical experience, but that it is the best form of water-tube boiler amongst those now generally in use is at least open to grave doubt. We were much astonished to see the other day the large extent to which the Yarrow type of boiler has been adopted in the Dutch Navy. No less than six cruisers are fitted, or being fitted, with Yarrow boilers of 10,000 H.P. each. Two battleships, one afloat and one in hand, are supplied with Yarrow boilers of 6,000 H.P., and two torpedo-boats have Yarrow boilers of 1,000 H.P. each. If the Dutch Government have thus selected this type of water tube boiler as the best, there must be something in it; and these boilers are also favoured by the Russian Government, and are being put into Portuguese and Norwegian cruisers by the great Elswick firm. Apparently then these competent judges have decided that they need not go either to France or the United States for what they consider the best type of water-tube boiler. We also must not forget that H.M.S. *Salamander* has been fitted with Mumford water-tube boilers, which have made a very good record. There appear to be two distinct types of water-tube boilers: those with short, steeply inclined or nearly vertical tubes, which, when allied with very thin sections, may be termed express boilers; and those with larger, almost horizontal tubes of thicker sections; and so far, for large steamers and for naval cruisers, the latter type has been considered to a large extent the only type suitable. It is, however, held strongly by expert opinion that the latter part of long water-tubes is of little value for evaporation as compared with the first part of such tubes; and for evaporative efficiency comparatively short, steeply inclined tubes are probably more efficient. It is well worthy of consideration whether the express type of water-tube boilers—such as those of Thornycroft, Yarrow, and Normand, modified as to section and diameter of tubes for greater durability where a minimum of weight is not so essential as in torpedo-boats or destroyers—may not be the better type, when properly modified, for cruisers and battleships.

We are in a revolutionary age in mechanical design, owing to the quick evolution of scientific research and invention. The problem of the steering and control of torpedoes through an unconnected distance, such as from a vessel or from land, has, it is said, received a practical solution from a young Swedish inventor. Surely the inventive genius of the men of to-day in perfecting weapons of offence is war's most deadly foe. The cold-blooded scientific slaughter of opposing forces will make such conflicts too murderous to be characterised by the chivalrous name of war. A Mr. Axel Orling, in conjunction with a Mr. J. T. Armstrong, of London, has discovered a new way of transmitting motive power by means of light, the rays employed being those ordinarily invisible, as in the X rays. Such rays may thus be used invisibly from a controlling station, either on board ship or on land, to control and steer, if not to impel, a submerged torpedo; and to determine at any time the discharge of a detonator, by which the explosion of the torpedo can also be determined at any moment by the control. All that is required for the receipt of the controlling rays is a white disc mounted on a shaft projecting from the torpedo above the water. At night time the projecting rod carries an electric light as an indicator of position to the control, whilst shaded and protected from the observation of the enemy. This invention is not merely a matter of theory, but has been tested experimentally in Swedish waters, where, by command of the King, torpedo-boats and torpedoes were placed at the service of the inventor—somewhat a contrast to the ungracious and repressive manner in which our Admiralty receives any offer to experimentally test new inventions. We understand, as a result, the Swedish Government have decided to take up this invention, and have acquired the Swedish patents. Mr. Orling, we understand, is now engaged in working out an idea for an air-torpedo to be controlled by the new rays. If the young Swede's expectations should be realised, it would appear that both land and naval warfare, as at present known, would be revolutionised, if not rendered impossible.

GOSLING'S FORCED DRAUGHT.

THIS method of forcing draught is of an extremely simple nature, as is shown by the figures in illustration of its application to the furnace of a water-tube boiler. It consists of a horizontal tube, Fig. 1, placed along the front of the ash-pit with tubes at right angles to this under the fire-bars. These tubes under the fire-bars have a bell-mouth, and a nozzle attached to the tube in front of the ash-pit blows steam into them, inducing air to follow and mix with it. The tubes under the fire-bars are perforated, and the mixed air and steam is blown through the fuel above the bars. These tubes under the fire-bars are about 4½ in. diameter. The hole in the steam nozzle is 1-16 in. diameter, and the steam to supply these is obtained from the boiler, as shown in Fig. 2. The fire-bars are placed close together, the distance between being only about ⅛ in.

This type of forced draught is an aid in the case where the chimney is insufficiently high, and it also enables the commonest classes of fuel—such as slack coke, breeze, dust coal—to be used efficiently, and the makers claim that as high an efficiency is obtained from this poor coal as is obtained from the best when burned under ordinary conditions. It is also claimed that, whatever kind of coal may be used, the fire-bars remain free from clinkers adhering to them, and there is thus less waste of fire-bars, which is a serious item in ordinary cases. There is a more equable distribution of consumption of the coal over the area of the fire-grate. and there is not the same tendency to holes being formed in the fire as in ordinary cases. This formation of holes acts very seriously against the proper consumption of the fuel, and is wasteful in its application of the air of combustion. In such cases the air goes through the bare places, and does not mix sufficiently amongst the gases to be consumed, and thus passes up the chimney as mere heated air, which reduces the economy of combustion. Sometimes also, where the air is supplied under pressure, there are back explosions; and to prevent these the draught has to be shut off before the fire-door can be opened. The furnace-door may be opened with safety with this type of forced draught.

With Gosling's forced draught no fans, engines, movable or perforated bars are required. Several tests have been made to demonstrate the advantage gained by the use of this system of forced draught. The following is given by the makers as having been conducted:—

NATURAL DRAUGHT WITH SMALL COAL.

lbs. of coal consumed.		gallons of water evaporated.		lbs. of water evaporated per lb. of fuel.		cost of coal per ton.		cost of evaporating 1,000 gallons.
72,128	..	45,852	..	6·25	..	9s. 6d.	..	6s. 8d.

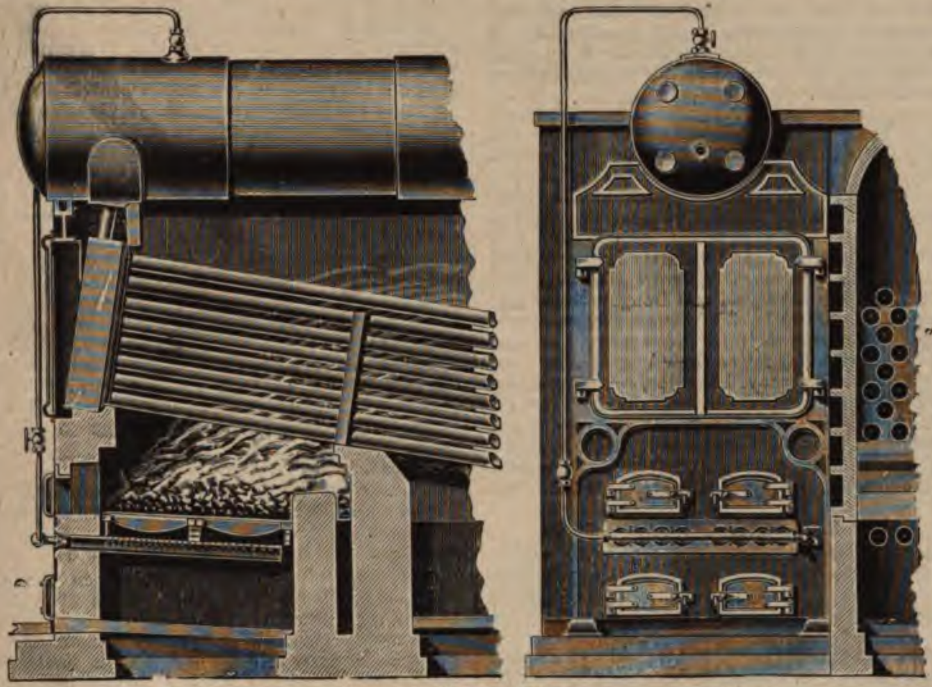


FIG. 1. GOSLING'S FORCED DRAUGHT. FIG. 2.

FORCED DRAUGHT WITH SMALL COAL.

59,534	..	47,224	..	7·92	..	9s. 6d.	..	5s. 4¼d.

In another case where a trial was made, with this system fitted to one Lancashire boiler and ordinary draught to the other; the boiler with the forced draught evaporated 606·9 gallons of water in half-an-hour, whilst the boiler with natural draught evaporated 469·6 gallons in the same time.

An advantage of the system, which is designed and manufactured by the Forced Draught Syndicate, 73, Queen Victoria Street, London, is that more power can be obtained from a series of boilers without the necessity of increasing their number.

Institution of Naval Architects.—The summer meetings of this Institution will be held at Newcastle-upon-Tyne and Sunderland, on Tuesday, July 18th, and the four following days. The Right Hon. the Earl of Hopetoun, G.C.M.G., will occupy the chair. Papers have already been promised by Sir Andrew Noble, K C.B., on "Naval Artillery"; Mr. P. Watts, on "Elswick Cruisers"; Mr. H. F. Swan, on "Ice-breaking Steamers"; Mr. F. Marshall, Jun., on "The Boiler Arrangements of some Recent Cruisers." A paper has also been promised by Mr. A. F. Yarrow, and a joint paper by Herr Otto Schlick and Mr. John Tweedy.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

Lane Routes.

ON the authority of the master of a Norddeutscher Lloyd liner, the New York correspondent of the *Shipping Gazette* makes a serious charge against the Anchor Line s.s. *City of Rome*, and against those who are responsible for her management and navigation. It is said that the Norddeutscher liner in question bound west sighted the *City of Rome* bound east, and that this fact proved that the latter was thus to the south of her lane route. The fact of the sighting is not denied, so the story goes. But the explanation is given (*a*) that the Anchor Line was not a party to the agreement whereby the lanes were adopted. To this it may be said that neglect to join the agreement does not prevent people from following the course recommended by the united wisdom of the principal owners of the mail-boats of the world. (*b*) Then it was urged that the vessel was not bound to the same port as the Liverpool liners. This contention is obviously true, but there is absolutely nothing in it. It was true also of the Norddeutscher steamship which reported her. But the fact did not prevent the German boat from keeping the track for a considerable part of her run. It would affect the *City of Rome*, too, less than the German boat, on the east-bound course at least, for, whereas the German vessel was bound to the English Channel, the Anchor liner's destination was Moville at the North of Ireland. Lastly, the agents of the line say that the vessel was doing as she did because she had orders to go far south to avoid ice. A most laudable purpose is that of escaping possible risk; but the lanes themselves are laid out with the full knowledge of the ice and its dangers, and that defence therefore amounts to little. In point of fact the *City of Rome* seems to go very much as her fancy directs her. I have noticed her as reported from Cape Race on more occasions than one. It is very much to be hoped that the publicity now directed to her manœuvres will cause her and the Anchor vessels generally to follow the usual practice of the trade, and keep to the lanes, for dissent from the general practice by a few vessels largely nullifies the precautions of the great majority. Possibly a reminder of the fact that going out of the lane is sometimes fatal to the vessel which chooses her own course may be an argument which will appeal to those whom nothing else will move.

Last Month

I stated that there was a rumour afloat that La Compagnie Générale Transatlantique was about to buy the old Hamburg-American liners *Columbia* and *Normannia* which Spain bought at the time of the war with America, and did *not* use as auxiliary armed cruisers. I mentioned that there were certain obstacles in the way of their use by the French company in consequence of the fact that the arrangements with the French Government under which their mail subsidy is receivable forbids the employment by them of foreign-built ships—both the *Columbia* and the *Normannia* were built in the United Kingdom—for their mail service. There are obviously great difficulties in the way of a company which proposes to buy vessels of a class superior to any vessel in their fleet, save one, when the vessels in question are absolutely debarred from sailing save as extra and occasional boats, and are thus incapable of serving as a stand-by in case of emergency. So it is not surprising to hear it reported that the *Columbia* has been repurchased by her original owners, the Hamburg-American Line.

The Old "Ireland,"

whose sale by the City of Dublin Steam Packet Company I reported last month, is to be employed in the annually renewed attack on the preserves of the Isle of Man Steam Packet Company. This company "asked for it" when it bought off opposition in previous years. It has got it. One of the last assaults was threatened by the employment of the now nearly forty-year-old paddlers replaced by the present twin-screw Holyhead and Dublin mail boats. Now the Liverpool and Douglas Steamers, Limited, whose capital is £50,000 in fifty-pound shares, comes fresh to the attack with the *Ireland* in the front rank. Amongst their powers I notice the right (as far as their shareholders are concerned) to carry troops. Do they, I wonder, contemplate an actual invasion of Hall Caine's Little Man Island? At all events, though their ship is a fairly good one, they have a vessel that simply eats coal with her single-expansion paddle-engines, and the coal bill may perhaps prove an obstacle in their way when they come to a close grip with their old established rivals.

A Pilot Sued.

Judge Shand, of the Liverpool County Court, has just had a very unusual suit tried before him under the Admiralty jurisdiction of his court. In December last a collision took place in the river Mersey between a small steamer, the *Elsa*, and the big Transatlantic steamer *Rossmore*, now lost in the Atlantic. A collision case came in the usual way before the Admiralty Division of the High Court. In it the *Elsa* was found solely to blame; but her owners were freed from their liability because of the fact that at the time the accident happened their steamer was, by compulsion of law, in charge of a pilot. So failing to get any compensation out of the owners, Messrs. Johnson have sued the pilot. The facts of the case were again gone into, but the county court judge, like him of the High Court, found that the *Elsa* was alone responsible, and so the pilot of the *Elsa* was held personally liable for the damage sustained by the *Rossmore*. This adds a new terror to service in the mercantile marine. The liability has ever been there. There is nothing new in the law. But it is still quite a new departure to bring in the personal responsibility for his acts to the working man of the ship. The pilot is hit here. But it should not be forgotten that circumstances might be conceived easily enough under which the navigator or the engineer on duty might find himself responsible to owners of a colliding vessel for default in his particular work.

"La Bourgogne."

Whilst touching on legal matters it may be interesting to mention that the appeal of La Compagnie Génerale Transatlantique against the finding of the English Courts—that they, as carrying on business in London, were amenable to our law for the damage occasioned to the *Cromartyshire* by the collision between her and the ill-fated mail steamer *La Bourgogne*—has been carried to the House of Lords. But the French company found no relief. The Lord Chancellor expressed his admiration of the skill which enabled counsel for La Compagnie to make bricks (or something that looked like bricks) without any straw whatever. But he and his august brethren could see no ground for reversing the decision of the courts below, and so, as far as can be gathered, the game is finally ended in favour of the *Cromartyshire*. I trust this may be the last occasion on which it is necessary to refer to this very sad history.

The Russian Volunteer Fleet

will yet have further assistance from its Government in the future. It has been decided that, with a view of encouraging Russian trade and navigation in the Pacific, the State shall for the next 10 years pay the dues of all Russian merchant steamers passing through the Suez Canal. This is a substantial concession indeed, and it should be a very great assistance to that already highly subsidised auxiliary to the Russian Navy. But it is possible that the effect of the bounties—for such in fact they are, though they may be somewhat disguised—will be such as to induce purely merchant steamers to trade under the Russian flag and may thus bring some competition into the freight market for steam tonnage between Odessa and Vladivostock. In that case the encouragement now given might prove rather a doubtful blessing to the patriotic organisation. At all events it is likely to do British shipbuilders a good turn indirectly; for those who direct the volunteer fleet are in the habit of putting all their surplus earnings into new tonnage, and so it is probable that most of the money contributed by the Russian taxpayer for the encouragement of Russian trade to the Pacific will eventually be spent in the shipbuilding yards of the Clyde and of the Tyne.

The Accident to the "Gallia"

seems likely to be a more serious matter for those interested than was at first suspected. The vessel went ashore on mud in the St. Lawrence and took no hurt as far as the contact was concerned. But she was going up stream at the early part of the period of open navigation, when the water is at its highest. The work of lightening her was at once commenced, but even quicker than she rose the water fell. Where she lies will, it is said, soon be an island and cattle will be grazing alongside the stranded liner if she is not got back into deep water. Every effort is being made to avoid so serious a delay as a summer's stay in the St. Lawrence would involve. But the work progresses slowly. A deep channel has to be dredged for the passage of the ship; and it is said that, in order to enable her to work on the landward side of the *Gallia*, the dredger has first to scoop out a channel for herself. As we go to press, it is reported that she was safely floated on the 24th June, and is en route for Montreal.

The New "Oceanic"

is causing a good deal of movement in the *personnel* of the White Star Fleet. I announced some little time ago that Mr. Sewell, the commodore engineer of the line, was to have her machinery department in his charge. Now a movement has begun towards providing her with a navigating staff. The *Britannic*, which left Liverpool on the 21st June, had a new commander. He is Captain Hayes, till recently chief officer of the *Teutonic* and brother of the well-known skipper in the Pacific Steam Navigation Company's service. Captain Haddock leaves the *Britannic* for the *Germanic*, and her late commander, Lieutenant McKinstrey, R.N.R., gets the *Teutonic* in relief of Captain Cameron, who is to have the new leviathan. Speaking of the *Germanic* brings me to note that this vessel is once more in harness and is probably a better ship to-day than she has ever been in her long and popular career. After her unfortunate accident in New York harbour, when the weight of the frosty accumulations of the famous blizzard were too much for her as she lay in her dock, she was, as is probably not forgotten, brought back to Belfast under her own steam, though without passengers. She arrived there on the 17th March after a remarkably good passage, which showed conclusively enough that, whatever else might have suffered from her immersion, the machinery was in a highly satisfactory condition. At Belfast her builders, Messrs. Harland & Wolff, have given her a through overhaul, and on the 3rd June she came back again to Liverpool. That port she left on the 7th of the month, making a good passage outwards in the mail service to which she is now so happily restored.

The P. & O. Meeting

gave Sir Thomas Sutherland an opportunity of breaking gently to his shareholders something of the bill which they will have to settle for the disaster to the *China* last year. The first item must be the expenses which the owners themselves had to deal with locally in the Red Sea in their attempts to get the ship afloat and in the work of compensating passengers for their claims for property lost. Nothing is said about that.

But we are given evidence of the fact that if the ship was originally a very valuable one, the accident and her restoration to active service will be fully in proportion. The salvors were settled with for the record sum of fifty-seven thousand pounds. This sounds a lot of money, and is certainly a big sum to pay for the getting-off of a ship which when floated was of so doubtful value. But I do not think it necessarily a very satisfactory sum for the enterprise of the salvors, whose best men and best plant were on the job for about five months. Perhaps as time goes on we may get some indication of what the expenses of the temporary repairs at Perim and the final overhaul at Belfast amount to, and so may arrive at an appreciation of what the P. & O. will have to pay for the honour and glory of saying that the vessel was not a total wreck. Sir Thomas—as it is worth while to notice—takes some credit to himself for the fact that the ship is now in a fair way to restoration. I can understand credit being given for that fact to the builders, who put such good work into her as to enable her to withstand the experience or to the salvors who so skilfully blasted the rocks from under her. But there seems to me to be small praise due to the man who merely pays the bill for these things, especially when the total of that bill looks like being out of all proportion to the value which his shareholders are likely to gain from the affair. A worse thing is, however, in store for the "premier" line.

Messrs. Ismay, Imrie & Co.

have announced that on August 3rd their new twin-screw steamship *Medic*, of about 12,000 tons gross, will inaugurate a new White Star service from Liverpool via the Cape of Good Hope to Australian ports. The new adventure will, at first, make monthly sailings, and the re-entry of so famous a line into the Australian competition will make it very bad indeed for some of those who are already there. It is interesting to remember that after all this is a re-entry and not a new departure. The line has been in steam just under 30 years. But for a long time ere that period the house-flag was well known in the Australian trade with its clipper ships, amongst which were the famous *Red Jacket* and *White Star*. Even comparatively recently the firm had sailing vessels which they used as training ships for their navigating officers, and many of these vessels were in the Australian trade. Now we see what the building of the *Afric*, the *Medic*, and the *Persic* meant, and learn that two other sisters, to be respectively known as the *Runic* and the *Suevic*, are also on the way. These vessels will be practically sisters, and the five should make it possible to give a four-weekly service of twin-screw cargo boats from Liverpool to the Antipodes. The boats are of a high class hitherto quite unknown in the Australian trade. There are, of course, twin-screw mail steamers in the Norddeutscher-Lloyd and the Orient fleets, but none of these vessels approach the *Medic* and her sisters in size. These ships will be the largest ever seen in those waters. For their carrying power they will be cheap to run. The expense of the Canal dues will be escaped. They steam a good speed at a very economical rate of coal consumption, and should be able to shift cargo at the minimum of cost. Large refrigerating installations are to be fitted to them. This explains why the *Medic*, the second of the family launched, is to make the pioneer voyage; for her elder sister, the *Afric*, after making a run to New York, went back to Belfast to have the refrigerating machinery put aboard, and so she is not as forward in that direction as her younger sister. If sufficient freight be forthcoming to adequately fill these ships, they should prove very beneficial to their owners. Their success would be a great benefit to Liverpool and the busy manufacturing districts behind it; for Liverpool, so long without direct steam communication with the Antipodes, will be able to compete with London on advantageous terms for the carriage of the Australian wool to the northern manufacturing towns. The saloon passenger business will not be much disturbed by the new service, as the carriage of first or second-class passengers is not contemplated. But the third-class passenger will have an opportunity indeed. He will have the big ships to himself. His fare to Sydney will vary according to accommodation, from 14 to 17 guineas. The lower figure is that for passengers who travel in open berths. An extra two guineas will put such travellers in enclosed two-berth rooms, and a further spring of a guinea—to 17—will give them the privacy of two-berth cabins. The Cape can be reached for nine guineas. I have seen illustrations of the accommodation, and it is surprising indeed. The enclosed staterooms are fitted with comfortable berths, pegs for clothes, mirrors, and washband basins. There is a dining-room the full width of the ship, with the revolving chairs which were considered such a boon to the saloon passengers when they appeared aboard the old *Oceanic* in 1871. There are smoke-rooms and reading-rooms. Luxury is naturally absent, but the arrangements for comfort and cleanliness are remarkable. The panels in all the rooms are ventilated, and the seats in the public apartments may be described as of the garden chair pattern, which is cool, comfortable, and clean. In the reading-room there is even a piano. The scale of food offered is most liberal, and to many of those who travel by this line the accommodation and treatment will be quite beyond anything they have ever experienced ashore. The trip aboard the White Star boat will be looked back to as one of the pleasantest episodes in the emigrant's life.

Lord Kelvin

has added another to the many benefits he has conferred on those who go down to the sea in ships. This time it is not by invention that he offers safeguards to life and property. It is by using the position in Parliament which his high scientific attainments have won for him for the purpose of endeavouring to minimise the rush and pressure of speed of modern mail steamers, so that the danger of stranding or collision through fog may be decreased. On the 26th June he will, in his place in the House of Lords, ask her Majesty's Postmaster-General whether it be true that some of the mail contracts entered into by the Post Office with steamship owners stipulate for the performance of the service in a stated time with a penalty for occasions where such time is exceeded, together with a bonus in some cases for a certain diminution of the length of passage. Then he will ask whether in such contracts there may be inserted a saving clause remitting the penalty in cases where the lateness of arrival is due to the taking of seamanlike precautions for the safety of the ship. His question will in fact be a protest against the insertion in any mail contracts of such clauses as that which stipulates that "such penalties are to be inflicted from whatever cause arising." It should bring about the much needed reform of making it clear to the minds of those responsible for the safety of a vessel that the owners cannot in future suffer at the hands of one branch of the Government for the observance of the precautions which the safety of the adventure and the laws of another department of the State enjoin.

A New Seaside Service.

The amalgamation of the two railways which serve the county of Kent is now to all intents and purposes approved by Parliament, and we may soon expect to see further changes in the cross-Channel services which have hitherto been in competition with one another. The joint railways (who might with very good reason work under a much shorter name than that which they now bear) announce a new service which is likely to be very popular with excursionists. Every day of the week there will be run a steamer from Port Victoria to Margate and Ramsgate and back. In connection therewith a train service both up and down will be maintained from Charing Cross and London Bridge, so that those who patronise it will be able in the course of a day to get a good sea blow, and at the same time escape the tedium and delay of the river part of the journey. The idea seems a good one, but, unless facilities bring immediate expansion of traffic, it is somewhat calculated to interfere with the success of the work which during recent seasons has been so ably carried out by the steamships of the New Palace Steamers, Limited.

The "Paris'

at the time of writing is still on the Manacles. The Liverpool Salvage Association was not long suffered to continue its efforts for her release. Operations were taken over by order of the underwriters—to whom, I believe, the ship was early abandoned—by the London Association, and they had, after a time, to call in the assistance of foreign wreckers. The attempt to tow the vessel off at the high tides about the 25th May were unsuccessful, although half-a-dozen tugs were employed and the vessel's own engines were also worked astern. On the 26th the ship began to leak considerably in the engine-room, and on that day the weather became quite unfavourable, the ship moving a good deal in her uneasy bed. On the 3rd June the German salvage steamer *Berthilde* arrived and commenced work. Blasting operations for the removal of the rocks were continued, and platforming was also pressed forward in the damaged holds. But another gale sprang up on the 8th and the vessel filled, whilst her stern was also shifted about twenty yards further inshore, making her position much more difficult for the wreckers. She was now believed to be very badly damaged and her forward boilers were reported as lifted. She rolled so much that at one time it was thought she would go to pieces. Later reports, however, seemed to minimise the damage she had sustained at this time, and energetic means, by the supply of large pumping installations, were taken to cope with the influx of the water. On the night of the 19th she again had to be filled because another gale sprang up. The damage, however, on this occasion was believed to be slight. But the constant grinding on the rocks, together with that which she must have sustained through the fruitless attempts to drag her off by main force, must be serious indeed.

Details respecting the policies in force with regard to the *Paris* have transpired. From these it appears that the ship was insured for about £225,000. The bulk of the risk was taken by American offices, chiefly in Boston. It is said that altogether some forty offices are affected by the accident.

Mr. Smalley, the New York correspondent of the *Times*, had an interesting article the other day in this connection. He spoke of the *Paris* as being what the Americans would call a "tired ship," owing to the amount of labour which she had got through in her comparatively short working life, and to the pressure under which she had been run. He spoke of the way in which she had been driven against heavy head seas to the great discomfort of passengers and to the detriment of the ship herself. This policy of driving under such circumstances he most strongly deprecated, and contrasted it with the experience he had had in bad weather aboard British liners. He told how the *Germanic* and the *Lucania* had been eased down by their commanders in exceptionally heavy weather with results most satisfactory to all on board, and assured the managers that such action was appreciated by the customers of steamship owners. Curiously enough this article was shortly followed by a somewhat significant announcement, though I do not suppose that there was any case of cause and effect. It was a mere coincidence, and there can be no doubt that the managers of the American Line had arrived at their decision long before they read Mr. Smalley's remarks. They announce that a new steamship to supply the place of the *Paris* is about to be built by Messrs. Camp, of Philadelphia. The new vessel is said to be intended to have a length of 600 ft.—about that of the Cunarder *Lucania*—and to have a more moderate speed than some recent additions to the fleets of the mail lines. The American Line managers are reported to have come to the opinion already acted upon by Mr. Ismay in the building of the *Oceanic* that greater comfort at sea is more desired by passengers than increase of already excessive speed.

A Shipbuilding Amalgamation.

Early in the month of June it was reported that, following on the absorption of the Naval Construction and Armaments Company, of Barrow, by Messrs. Vickers, Son & Maxim, there was to be an amalgamation of the Clydebank Engineering and Shipbuilding Company, Limited—which, under the original name of J. & G. Thomson, had built, amongst other famous vessels, the *New York* and the *Paris*, as well as all the London and South-Western Railway Company's recent channel boats with Messrs. John Brown & Company, of Sheffield. The latter firm was established in the year 1864, and has earned a world-wide reputation for armour-plate manufacture.

Here may also be mentioned that Messrs. Scott & Co., of Greenock, which claims to be the oldest shipbuilding concern in the United Kingdom, has just become a limited company. The firm has built many vessels for Mr. Alfred Holt and for the B.I.S.N. Company. Five generations of Scotts have been in the business, and since 1824 there has been associated with it the Greenock Foundry, where the engines for the steamers built in their yard have been constructed.

The China

Earlier in these notes I spoke of the cost to which the P. & O. Company had been put to settle the claim for the salvage of this ship. I should not omit to mention the difficulties which Messrs. Harland & Wolff encountered when they came to dry-dock the vessel for her permanent repairs. She could not—owing to the fact that so much of her bottom forward and amidships was gone and had been temporarily replaced for the voyage home by timber backed with concrete—let her down on the blocks for her whole length in the ordinary way. So another plan had to be evolved. Eventually the following highly successful method was adopted. Through the injured portions of the vessel great square baulks of timber were inserted below the decks, the vessel's side plating being cut to allow them to project on either side. To correspond to these, uprights of similar strength were set on the altar courses of the deck at the proper intervals. When the vessel was floated in and the water lowered, the tops of the uprights took the horizontals, and so bore the weight of the damaged portion instead of allowing it to rest on the temporary work below. The idea was successful enough, but the task of working out the positions of the timbers and of placing the ship herself exactly in the right spot must have been a very anxious one.

CROSBY INDICATORS.

THE Crosby Steam Indicator has for some years past given engineers most satisfactory results, but the makers, not content to rest on their laurels, have found room for improvements.

The first is the improved design of bracket (Fig. 1), which serves as a fulcrum for the pencil-lever, thus giving increased rigidity. Then the pencil-lever has been made of special section to combine lightness with great strength, &c., whilst the connecting link is heavier to resist sudden shocks without vibration.

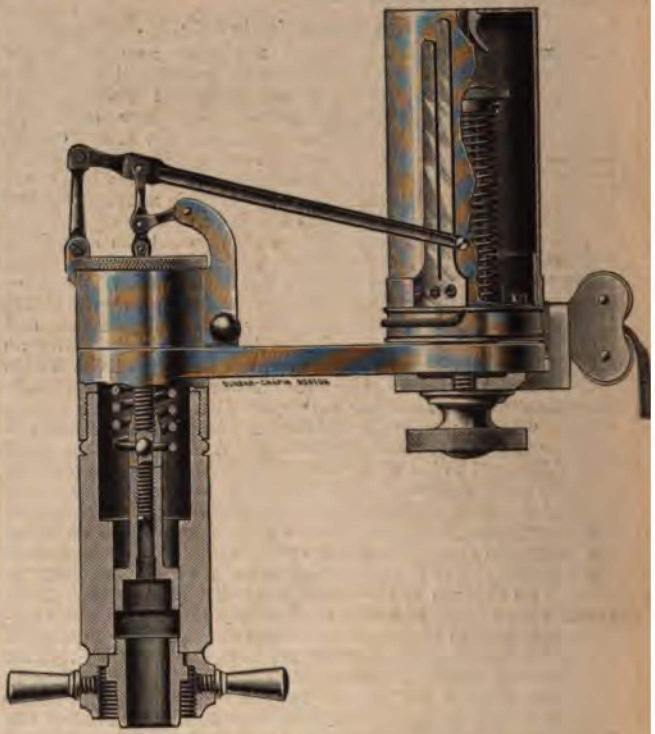


FIG. 1.

A new feature has been introduced to meet the trouble experienced in the testing of gas-engines when the pressure comes with a great and rapid rush on explosion of the charge. This has been overcome by a special design of cylinder shown in Fig. 2.

The cylinder is of extra length, and has two boxes; the upper one, to receive the piston used in the steam-engine indicator, being one-half a square inch in area; and the lower one, to receive the piston used in the gas-engine indicator shown on page 151, being one-quarter of a square inch in area. By replacing the smaller piston by the larger one, this special indicator can be used for steam-engine work, quite as well as the ordinary steam-engine indicator. The piston is made of hardened tool steel, and has its upper part, which connects it to the piston rod, lengthened to carry the piston entirely below the larger box and into its own cylinder.

There is also manufactured by the firm an hydraulic indicator for hydraulic pumps working against light pressure leads. The pencil motion is of the same heavy pattern as the gas-engine indicator, and it has also a post (shown in Fig. 2), bearing lightly against the pencil arm to keep the pencil point from being thrown away from the card by any sudden shocks.

The piston is made one-fortieth of a square inch in area, and fitted in a cylinder at the bottom of the instrument. A by-pass is made in the metal, at the side of the small cylinder, by which the pressure may be transmitted to the larger cylinder above, where the pressures to be received are not too high for the spring. This by-pass is closed tightly by the cock, shown in the cut above, where the small piston is used.

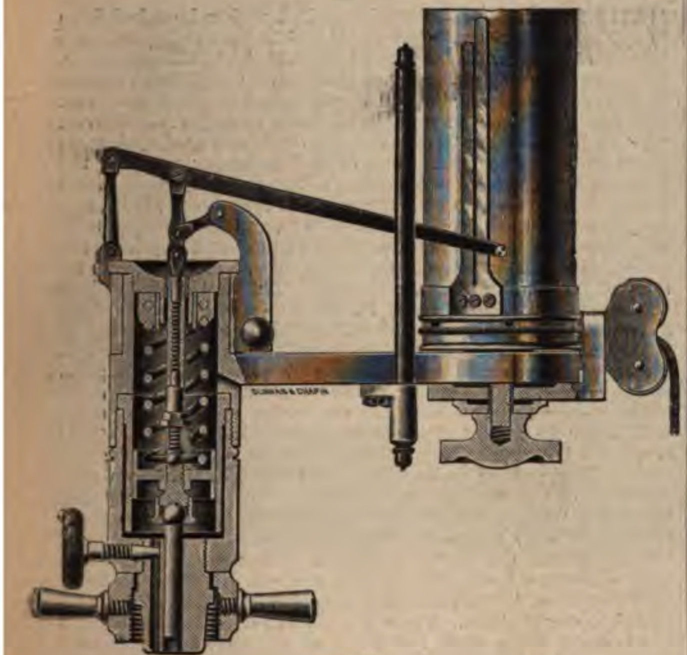


FIG. 2.

When taking the diagrams from the different cylinders of the engines of a torpedo-boat destroyer, it is difficult to obtain simultaneous diagrams, since that depends on three or four operators. Mr. Sargent has invented a device which will enable simultaneous diagrams to be taken by closing an electric circuit.

Fig. 3 shows the indicator with a Sargent electrical attachment. It consists of an electro-magnet, supported by a bracket. To the same bracket are attached binding-posts. The armature is opposite the magnet, and held by a spiral spring in the centre of the coil, the tension of which is adjustable by means of the screw at the back of the magnet. A hook is free to engage with a screw-eye inserted in the arm. The circuit-closer consists of a bracket with a tubular projection fastened to it, which contains the circuit-closing mechanism. It is attached to the indicator-plate by the thumb-screw in precisely the same way that the magnets are to the other indicators, and is electrically connected in the same manner through the binding-posts.

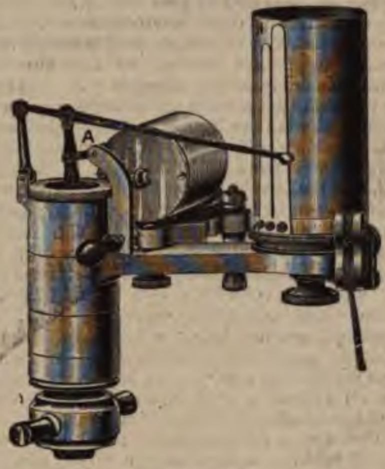


FIG. 3.

Suppose it is required to take simultaneous diagrams from a compound engine. Connect the battery, having all the magnets and the circuit-closer in series. Place the paper in the drum, and bring the pencil-arm into such a position as will allow the latch to drop into the screw-eye. Connect the drum motions, open the indicator-cocks, and close the circuit; instantly all the pencils will be brought against the papers, and will remain there as long as the circuit is kept closed. To put on newpapers; disengage the arm motions, lift the latch, and swing the pencil-arm out of the way.

WEIR'S FEED PUMPS.

TEN years ago it was only the largest-power steamers that were fitted with separate feed pumps, and up till a few years ago they were considered an innovation of doubtful success, but the advent of greater boiler pressure and faster running engines turned the scale in favour of the separate pump. The previous practice of fitting feed pumps on the marine engine had many disadvantages, amongst which the necessity of admitting a considerable quantity of air with the water to ensure silent working was one of the very worst points. The extra tear and wear, and the difficulty of keeping the glands tightly packed, of the marine engine feed pumps have gradually forced them out of the field in favour of the separate pump; and it is now the exception for marine engines to be fed direct from the engine in the old way.

Many kinds of pumps have been fitted as separate feeds, but the crank shaft, duplex, and outside packed pump have gradually given way before the Weir direct-acting type, and now it is rare to meet a marine engineer who has not been a shipmate with Weir pumps. So universally have they been adopted that it is hardly possible to go on board a mail steamer belonging to this or any other country that has not these important auxiliaries fitted in conjunction with the equally well-known feed-water heater.

The advent of the water-tube boiler, with its much higher pressure and carrying such a small quantity of water that a feed pump becomes a doubly important adjunct, has also been the means of opening a very extensive field for the Weir pump; and, although different kinds of pumps have been tried with indifferent success, it is now almost exclusively the Weir pump that it is fitted on this class of work.

There must be some strong reason for such a unanimous opinion amongst engineers, because they as a rule are men with diverse views, and almost in every other branch of engineering they have their hobbies and fancies that they adhere to.

The other evening, at a discussion in the Institute of Marine Engineers, one point was raised regarding the Weir pump that might have an important bearing on the question, viz., the steam consumption of auxiliary engines. In this respect it was astonishing to learn that a mechanical efficiency of over 90 per cent. was attained with the pump, and at a very low steam consumption; it was then stated that 22 lbs. of coal per hour would be sufficient to feed boilers of 1,440 H.P. This seems marvellously small, and had the statement not come from Mr. Weir's representative, it might have been questioned; but since then we have had an opportunity of seeing the results of some tests very recently carried out in presence of a third party, which we have no reason to doubt, and the statement was amply confirmed. When we compare this result with the performances of some other auxiliaries on board ship, it is much to their disadvantage, and we think owners would be justified in calling for guarantees and tests of their auxiliary engines.

But we are digressing, and coming to the reason for the Weir pump being so extensively used as a boiler feeder, we have evidently one good reason in the steam consumption. It must be obvious to all that a pump using twice the steam to drive it will only pump half the water into the boiler per lb. of steam used, and would instantly leave the field clear for the most economical motor. But in feed pumps there are other things to be considered as well as steam consumption; for instance, in the water-tube boiler feeding one previously mentioned, reliability is surely an important factor.

In a water-tube boiler the quantity of water carried is seldom more than a ton, whereas in the cylindrical type we get 35, 40, or 50 tons; and, following out this reasoning, it will be seen that it is a most important point with the water-tube boiler to have a reliable pump. In many cases the evaporation is so great that, should anything go wrong with the constant supply of feed, the boiler would be empty in four or five minutes. But the Weir pump is almost exclusively used for water-tube boiler feeding, and no further proof of its reliability is required. In no case can we remember a water-tube boiler coming to grief through shortness of water due to the pump having broken down.

Not very long ago some writers in one of the electrical journals gave the results of their test of boiler-feed pumps under their own control. The results are interesting, by way of comparison, although they show that electrical engineers in the country do not hold a very close communion with the marine engineer. One writer relates his experience of four pumps, the first of which delivers 31·3 lbs. of water per lb. of steam used against a head of 40 ft. No. 2 pump delivers 18·3 lbs. of water per lb. of steam under similar conditions. No. 3 pump delivers 1·77 lb. of water per lb. of steam when feeding boilers at a pressure of 160 lbs., and No. 4 pump delivers ·957 lb. of water per lb. of steam under the same conditions as No. 3; whilst the Weir pump, feeding a boiler with 160 lbs. pressure, could deliver almost 85 lbs. of water per lb. of steam.

The workmanship and materials of the Weir pump are another consideration, being most excellent. The makers have laid down large works specially adapted for the manufacture of this kind of work, and run their own iron and brass foundry.

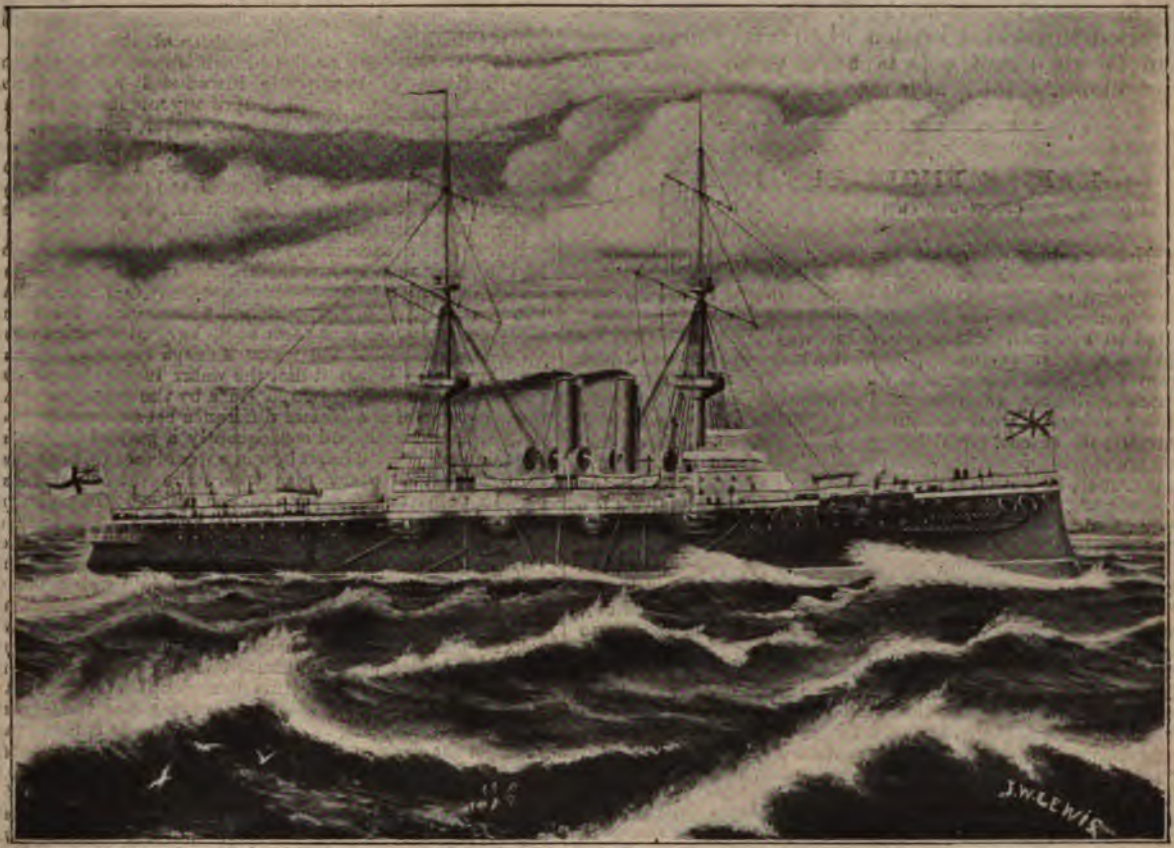
The Weir pump is arranged in several systems. The main engine feed pumps have a branch from the main feed pipe to the feed heater. They discharge directly to this from the hot well. Weir's pumps draw from the heater and discharge to the boiler. The pumps are independent of each other; but one pump is fitted with a cast-iron liner and steel-piston rod, whilst the other, which has a sea suction, is fitted with a gun-metal liner, bucket, and cold-rolled manganese-bronze rod. The iron-lined pump is used when the heater is in use, and the brass-lined pump when drawing from the sea. One pump is sufficient to deal with the entire feed-water, and the other may be a stand-by. The speed of the pump is controlled by the float in the heater. The exhaust is fitted to the atmosphere and low-pressure casing.

Another arrangement is to have a pair of pumps with a float tank and feed-water heater. In this case no pumps are required on the main engines. A feed tank with automatic float gear is placed under the pumps, and the air pump discharges into this. One of the feed pumps draws from the tank and discharges into the feed-heater, the other draws from the feed-heater and discharges to the boiler; the first is regulated by the float in the tank, the second by the float in the heater. It is so arranged that in case of accident either pump can feed direct to the boilers from the float tank without using the feed-heater. Sometimes a third pump acts as a stand-by.

When the speed of the engines is high, still another arrangement is in use. In this case there are no feed pumps in the main engines, only a pair of pumps and a float tank are used to deal with the feed-water. The water is returned to the boilers independent of the main engines; each pump is capable of doing all the work. The water is discharged by the air pump to the float tank, and the pump draws from the tank and discharges into the boilers. These pumps are fitted with gun-metal liners and cold-rolled manganese-bronze rods. A heater is not used, but the feed-water may be heated by leading steam from the high-pressure receiver and the exhaust of the pumps and other auxiliaries to the float tank. The water may also be heated by placing a surface feed-heater between the pumps and boilers, making it form a part of the main feed pipe.

H.M.S. "VENGEANCE."

THIS British line-of-battle ship, which will be launched from Messrs. Vickers, Sons & Maxim's Naval Construction Works at Barrow on the 25th of July, is of the *Canopus* class. The accompanying picture photograph, from a painting, depicts H.M.S. *Vengeance* as she will appear when completed for sea. She has 1 ft. 6 in. less draught of water than the *Magnificent*, which will enable her to pass through the Suez Canal, and, more important still, to enter some of the shallower ports of the Empire, her displacement being 12,950 tons, as against 14,900 for the *Magnificent*. The length of the *Vengeance* is 390 ft., and the beam 74 ft., whilst the depth is 43 ft. and the draught 26 ft. The broadside is of 6 in. armour, the length and depth of the belting being the same as in the *Magnificent*. The armour is an alloy of nickel, chromium, and steel. The trial plates of this thickness — 8 ft. long by 6 ft. wide — stood 6 shots fired at a distance of only some 6 ft. with a muzzle energy of 2,500 tons, and yet the 100-lb. projectiles were smashed to pieces, whilst no crack was visible on the plate. The 6-in. plate seems adequate protection in view of the ballistic qualities of modern guns and the fact that the future naval engagements will likely be fought at a range of fully half a mile. This armour will certainly keep out explosive shells. The protective deck is thinner than in the *Magnificent* class, but the gun protection is equally satisfactory, a feature in our modern ships for which Sir William White deserves compliment. The armament of the *Vengeance* is the same as in the other fourteen ships of the *Magnificent* and *Canopus* classes. There are two barbettes with armoured hoods, one forward and one aft, and each is to have two 12 in. 45-ton breechloading guns, so mounted as to be loaded in any position. There are to be twelve 6 in. 100-lb. guns of the quick-firing type, two firing ahead and two astern and three on either broadside, but the forward and aft pair of broadside guns can also fire in line with the keel, so that two are bow and two stern chasers; whilst for similar use there are two 12-lb. quick-firers forward and two aft, the other eight being on the broadside. The *Magnificents* have an extra pair of 12-pounders in the bow fire, but this is the only difference. The new ships will have four submerged tubes for the discharge of torpedoes; those above water have been found dangerous owing to the possibility of the projectile striking them when a torpedo with its gunpowder charge is lying in the tube ready to be discharged at the enemy. The engines are to be of the triple-expansion type, with cylinders 30 in., 49 in., and 80 in. diameter respectively by 4 ft. 3 in. stroke. These are to run at 110 revolutions, with 13,500 I.H.P. This, it is anticipated, will give a speed of 18½ knots, whereas the vessels of the *Magnificent*-class have a speed of 17½ knots, although some of them on their trials slightly exceeded this. This gain is in part due to the reduced draught and increased area, and it is the more certain of realisation as forced blast is not resorted to, as in the *Magnificents*. The boilers are of the Belleville type, with economisers added. There will be twenty such boilers, the total grate area being 1,050 square feet, whilst the heating surface is close upon 33,800 square feet. The total weight of machinery is 1,290 tons, so that the power is equal to 10½ I.H.P. per ton of machinery; whilst with natural draught the *Magnificents* and *Renowns* only give 8 I.H P., and even with forced draught 9·6 I.H.P. In other words, for only 12,000 I.H.P. the weight of machinery in the other ships was 1,300 tons, so that with less weight the new ships have 500 I.H.P. more, giving an addition of three-quarters of a mile to the speed per hour. This is a moderate estimate of the advantage accruing from the adoption of Sir Albert Durston. It may be added that specially onerous conditions are given in connection with the boiler tubes. If a relatively small percentage of any group of tubes submitted for trial prove unsound, the whole group is liable to be condemned.



H.M.S. VENGEANCE.

It is interesting to note in connection with the *Vengeance* that she is the first battleship ever built and thoroughly completed by one firm, because Vickers, Sons & Maxim have not only built the ship and constructed her engines and auxiliary machinery, but they have the order to mount her with their own guns, and they had already supplied their own armour plates for her construction. This is an undoubtedly big achievement, but in course of time still further developments will be made at the Barrow shipyard with the view of enabling the firm to establish other departments of their works, so as to be able to do all the work in connection with shipbuilding, engineering, boiler-making, gun manufacture, gun mountings, armour plates, &c., in their own yard. The order for the *Vengeance* was given in July, 1897. Her hull is very nearly completed, and her engines are ready to be lifted into the ship as soon as she is launched.

Steam Syrens.—We are informed that the Admiralty have instructed Messrs. Sydney Smith & Sons, Basford Brass Works, Nottingham, to fit up on board H.M. warships *Arrogant* and *Jupiter* the largest type of their patent steam syrens, which are to be operated by geared appliances. These syrens have long been used in the mercantile and naval service, so that their efficiency and merits have long been established.

SPECIAL MACHINE TOOL FOR SHIPBUILDING REQUIREMENTS.

MESSRS. CUNLIFFE & CROOM, Limited, of the Broughton Ironworks, Manchester, have recently completed for a large shipbuilding firm on the Mersey a specially designed duplex vertical milling machine, of which we give a page plate illustration. This machine is so constructed that it can be operated either as one tool for heavy, or as two separate tools for lighter operations. The bed is of strong box pattern, 15 ft. long, with four wide bearing surfaces to support the tables, which are each 10 ft. long and 3 ft. 6 in. wide, and provided with variable self-acting feed motion in either direction, and a quick return by power both ways. The milling headstocks and tables can be run separately as two independent machines, or the tables may be coupled by means of an endless chain, which is easily detachable, and one or both heads put in operation. The two headstocks, which are mounted on a strong cross slide, are provided with independent driving and feed motion horizontally and also quick hand adjustment in both motions. When the cutters are employed on side milling or profiling, the bottom end of the mandrel is received and supported by means of a circular support, and when it is desired to mill brass or gun metal, or the tool is only required for light cuts in wrought iron or steel, the back gear can be thrown out of action. Two portable circular tables are provided—one on each of the long tables—with self-acting feed, when circular milling, such as round the ends of connecting rods and similar work, requires finishing. All the motions for starting, stopping, and reversing the feed and the quick-return motion, are within easy reach of the attendant standing at either side of the machine. A pump and cistern are provided to keep a constant supply of lubricating fluid on the cutters when working. The machine is constructed to resist vibration when taking heavy cuts, and it will admit objects 8 ft. wide between the uprights. All the gear is machine cut.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

AN interesting discussion has taken place at the Institute of Marine Engineers' on the paper read by Mr. McArthur on the comparative performance of two steamers. The author gave one steamer as having been built and fitted to contract, while the other was built to sell. He gave a number of figures, and the inference to be drawn from the figures was that it did not pay to work a steamer which had been got cheap. For example, one of the most telling things against the steamer built to sell was that it used 1·7 lb. of coal per I.H.P. per hour and ·00488 lb. of coal per ton carried per mile, whilst the contract-built steamer used only 1·23 lb. of coal per I.H.P. per hour and ·00316 lb. per ton carried per mile. The author did not separate in his analysis the performances of the boilers and compare them, or of the engines, which were quite different in dimensions and performances. The pumps were different, and so were the propellers; and the author did not give the differences of the performances due to these. Then the dimensions of the ships were quite different, and the tons were not given; and the weather, wind, and course were not given in either case. Mr. Adamson, in the discussion that followed, gave figures for the performances of steamers. In some cases the figures given for the same steamer over the same course differed quite as much as the two different steamers given by Mr. McArthur. The only factors which caused the difference in the figures given for the same steamer by Mr. Adamson were weather, wind, and current. Yet the consumption with a vessel of similar dimensions to those given in the paper per ton of displacement was on one occasion ·0461, and on another occasion ·0643. This is quite as great a difference for the same steamer over the same course as exists between the contract-built steamer and the steamer built to sell, given by Mr. McArthur. The conclusion, therefore, to be drawn is, that the wind, weather, and sea may account for the difference given in the performances of the two steamers. Though, therefore, the comparison of the performances is of little value, the figures and statement given are of much value to the members. For example, the question of the steam used by the pumps was raised. From the paper on auxiliary machinery, and even this, and also the paper on the trials of the *Minneapolis*, the only conclusion which could be drawn as to the performances of pumps was that between 90 and 250 lbs. of steam were required by pumps per pump H.P. The article on Weir's pumps, in another column of this issue, will show what can be done in this respect. Another question raised was the size of grate surface compared with heating surface, the rates given being 1 to 52. In some cases it goes as low as 1 to 25. With regard to the grate, it should be remembered that the experiments conducted by Mr. D. K. Clarke showed that within certain limits the smaller the grate area the better. The excellence of the results obtained by Mr. Mumford by his water-tube boilers is in no small degree due to the small area of his grate, and the high efficiency of locomotive boilers is due greatly to a deep fire and strong draught. There are other features which enter into the excellence of the work done by the locomotive boiler, but these are some of them. Mr. Bruce brought forward the question of draught and the supply of air to the furnaces. A supply of too *much air*, which causes the hot gases to heat up the superfluous air and send it up the chimney as waste heat, should be guarded against. Excess of air one must have, but as little excess as possible should be aimed at. It is curious that the locomotive, which has the strongest draught, should use the least air of combustion, and at the same time have the highest efficiency as to complete combustion.

The fine weather has caused the younger members of the institute to go in for lighter amusements than the discussion of papers or the attendance at lectures by Mr. Hawthorne. A tennis club has been started, the court being the lawn at the back of the institute premises. Mr. W. J. Taylor is president, Mr. R. Leslie vice-president, the captain is Mr. W. E. Farenden, and secretary Mr. H. H. Mather. The name of the club is the Institute of Marine Engineers Tennis Club. The qualification for membership is—(*a*) Membership of the institute in any grade; (*b*) Relations (ladies or gentlemen) of any member of the institute of any grade introduced by that member; (*c*) Friends (ladies or gentlemen) of any member of the institute of any grade introduced by that member, and proposed by one other member of the club. All members of the club to sign the visitors' book in the lobby on arrival. The fee for the season is 5s. per member. Any member of the institute of any grade can take part in a set at a charge of 3d. per person per set if the court is not fully occupied.

There was an exceedingly animated discussion at the institute on the paper read by Mr. G. Halliday on the "Heat-Absorption Power of Water." Mr. Macfarlane Gray and Mr. Williams, of the Board of Trade, took part in the discussion. Mr. Macfarlane Gray could not see that there could be a falling-off of absorption when the velocity of the water through the tube rose above a certain value. When it did, the water inside the tube was not raised quite so high in temperature by the steam outside, consequently there was a greater difference between the temperature outside than inside, and consequently a greater transmission of heat per minute. That is how one would reason, but experiment showed that in every case where the velocity rose above a certain point the transmission per minute fell. The point of maximum absorption varies. It appears to depend on the quantity of heat supplied. If the quantity of heat is great, the velocity of the water when the maximum transmission takes place is greater. It appears as if a certain wetness of surface was necessary when the maximum transmission takes place. When this wetness of surface has been reached, and the velocity goes beyond this point, there is loss. This is possibly due to the heat being conducted to the inside of the moving column of water, and the time given for this being shorter.

Mr. Leslie writes from Calcutta, saying that the formation of a new branch is being talked about there. It is being talked of amongst the engineers of the British India Company's steamers, and someone has offered to be secretary of the affair *pro tem*.

Mr. Adamson has written a long letter to the Board of Trade on the question of the new regulation for the examinations for engineers. The notable improvements in the drafted rules of the Board are those which define the necessary workshop service, and No. 9 rule shows that the examiner can request a definite statement as to the sea service of candidates. Article 22 is referred to by Mr. Adamson, and the gist of it given as follows:—(*a*) The five years' workshop service, on which the Board will now insist as a minimum before a candidate presents himself for a second-class certificate; (*b*) The definite time that a candidate must serve in special departments of the works, in order to qualify him, is specified distinctly. The time allowance for candidates attending a technical school is considered to be too much, and by resolution the institute requests that three years in a technical school should count as one in the workshop.

Then the question of a third-grade certificate is raised, although it is not referred to in the draft submitted by the Board of Trade. The institute considers that something ought to be done to furnish the junior members of the merchant fleets with a certificate of competency. But is not this foreshadowed in the suggestion in the draft with regard to the powers of the superintendents of the fleets? These superintendents have in certain cases to furnish certificates of competency, which are to be examined by the officers of the Board of Trade, and in a way these certificates of the superintendents may be looked at as third-grade certificates. The superintendents, being conscientious engineers, would not in any case furnish any young engineer with a certificate if he were not competent, and thus those certificates submitted to the officers of the Board of Trade are really third-grade certificates. What the institute's duty is in the matter is very plain. It is the duty of the institute to enhance the value of these certificates, but to use their influence with the superintendents to increase the value of the certificates until they stand as a recognised entity before the country. How, then, can this be done? By attaching a definite course of instruction both in the theory and practice in the construction of marine machinery. It is for the council of the institute to suggest a course and prescribe rules, to be submitted to the superintendents of the merchant fleets.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

The Hydrographer's Report.

A MOST interesting report on naval surveys has just been issued by Admiral Wharton, the Hydrographer to the Admiralty. The number of officers and men employed in the surveying branch of the Navy, according to this report, is only 714, of which 75 are officers, and the work they have accomplished is astonishing. Although these surveying vessels have been at work for so many years, and have done so much each year, the amount of work to be got through seems to increase rather than decrease with every succeeding twelvemonth. Admiral Wharton states that 11 vessels were employed in coast and other surveys, during 1898 757 miles of coast line were charted, and soundings taken over an area of upwards of 10,000 square miles. Reports have been sent in from all parts of the world, but particular interest attaches to the report of the work done by the *Waterwitch* in Chinese waters. The crew of this vessel surveyed Wei-Hai-Wei Harbour in the summer of last year, and also did excellent work on the island of Leu Kung Tau, and in and about the harbour of Tinghai. The *Stork*, which was at work in the Red Sea, and the *Penguin*, in the South Pacific, made some interesting discoveries. Commander Gedge, of the first-named ship, found that there is one permanent surface current setting through the Straits of Babelmandeb, and another setting in the contrary direction below the depth of 75 fathoms. Captain Field, of the *Penguin*, took some exceptionally deep soundings in the South Pacific, including one of 4,762 fathoms in the vicinity of the Tonga Islands. Metis Island, Captain Field reports, has vanished altogether. Other vessels reported the discovery of a great many new shoals and rocks in the track of shipping. Altogether Admiral Wharton's report may be recommended as excellent reading matter, being both entertaining and instructive.

A Foundry at Sea.

The work done by H.M.S *Vulcan*, now stationed in the Mediterranean, gave to the Navy Department of the United States the idea of building a similar vessel which could do all the repairs, or a great part of them, of a squadron at sea. Therefore the department set to work, and had designed for them such a vessel, and when she was built and ready for sea gave her the name of our own torpedo depot ship in the Mediterranean. A most interesting article on the work done by this ship, especially whilst attached to Admiral Sampson's fleet off Cuba, appeared in last month's *Engineering Magazine*. The account is written by Chief Engineer Sims and Professor W. S. Aldrich, both of whom had charge of the fitting-out of the ship and of her work while under Admiral Sampson. These gentlemen assert that a foundry at sea had not been heard of before the cruise of the *Vulcan*, and go on to say that whatever other kinds of naval repair work had been executed heretofore on board ship, that of making large brass and iron castings had not been attempted. In her facilities for this new line of work the *Vulcan* stands pre-eminent and alone. That the unique equipment for foundry work was successful is more than shown by the fact that thousands of pounds of iron and brass castings were made and finished for the ships of the fleet. The brass furnaces were kept in almost constant service, sometimes running off two heats a day, and making it necessary to carry the work far into the night. In iron castings not more than one heat was run off in a day, and that usually about three o'clock in the afternoon, for, after filling the moulds and dropping bottom, it was practically impossible to do much more in that part of the ship until the next morning. We have no ship fitted in this manner in the British Navy.

Portsmouth Dockyard.

The Channel Squadron and part of the Reserve, which now lies at this yard, are being prepared to take part in the manœuvres, which commence in about three weeks' time. The *Latona*, *Naiad*, and *Sybille* have been brought forward for mobilisation, and the *Terrible* is also to be prepared, to be ready, if possible, to take part in the manœuvres, as well as the *Andromeda*, *Europa*, *St. George*, and *Gladiator*. The ratings in reserve are 3,800 in the depot, including bluejackets, mechanics, stokers, and marines, 1,500 bluejackets at Whale Island undergoing instruction, and 890 men going through the *Vernon*. The Channel Squadron is supposed to be ready for sea by the 4th of this month, but, unless a great many defects are left unattended to, the order to this effect cannot be carried out. Mechanics are said to be very short in the squadron, and great difficulty is being experienced in getting men to fill the vacancies. Among the ships which have recently arrived here from abroad is the *Narcissus*, which was paid off on the 22nd of last month, after she had been dismantled. The *Fox* has also returned from the Cape Station, and the *Pallas*, which has just returned home, is to be prepared for another three years' commission abroad. She has already served two commissions on a foreign station. The *Intrepid* has also arrived from the North American and West Indies Station, where she has served a somewhat eventful commission. There is some talk of the *Barham* being employed as a Royal Naval Reserve drill ship. She has successfully passed through her steam trials, and although she is fitted with water-tube boilers and modern guns, the fact that her bunkers are only capable of holding 225 tons of coal goes to show that she is not of much use except for employment nearer home. As regards the *London*, work on her steadily continues, and most of the plates of her upper deck have now been placed in position. Early last month about one hundred journalists from the press gallery of the House of Commons visited the yard, so that in future they could have a better understanding of naval subjects as they came up for discussion in the House. The Navy League also visited the Dockyard and Whale Island a week ago, when the Earls of Drogheda and Denbigh were among the visitors. It may be officially mentioned here that the *Seagull*, the only vessel in the Navy provided with the Niclausse type of water-tube boiler, carried out several steam trials in a very satisfactory manner. She is to have five trips of 1,000 miles each, at varying rates of speed, as soon as she can be prepared for commission.

Old Names for New Warships.

No fault can be found with the names chosen for the four new armoured cruisers which are about to be commenced, in accordance with last year's naval programme. Two of these vessels are to be built at Portsmouth and Pembroke respectively, the vessel to be laid down at the first-named yard being named the *Kent*, and that to be laid down at Pembroke to be named the *Essex*. Both names are closely connected with the old navy, for it is on record that a vessel of the name of *Kent* captured the Spanish line-of-battleship *Princesa*, and the name has been borne by various vessels which have fought in all sorts of actions from the battle of Malaga onwards. A vessel of the name of *Essex* took part in the battle of Malaga, and a vessel of this name fought at Quiberon Bay. The other two cruisers are to be built by the London & Glasgow Engineering & Shipbuilding Co. and the Fairfield Shipbuilding Co., and are to be named the *Monmouth* and *Bedford* respectively. The name *Monmouth* recalls the time when the Dutch came up the Medway and burnt our warships, but vessels of the same name took part in the victories at Barfleur, Vigo Bay, and the capture of Gibraltar. It was a *Monmouth* also that captured the *Foudroyant* in 1758. A *Bedford* fought at Malaga in 1704, and in the West Indies and on the American coast during the last century. All four vessels will be of the same length as the *Cressy* class, and their breadth will only be 66 ft., and they will displace 9,800 tons to the *Cressy's* 12,000. The *Kent* is to steam 23 knots, and the other vessels 22. The new cruisers will have two protective decks, of which the lower will have a considerable curve, extending the whole length of the ship. A transverse vertical armoured bulkhead crosses the ship abaft the engine-room, and the 4 in. side armour is to extend from the bulkhead to the bows. The space between the two armour decks forms the reserve bunkers. The vessels will be armed with 14 6-in. guns, 10 12-pounders, and smaller weapons. Their coal capacity is to be 800 tons as a normal supply, with a total capacity of 1,600 tons.

The French and English Construction Records.

The proposed launch of the French battleship *Suffren*, on the 25th of this month, reminds one of the claim made by the French builders that they have beaten the record for speedy warship construction. The *Suffren* was laid down in January last, and, if she is launched at the time stated, will have been on the stocks only six months and twenty days. That this is a hollow claim must be seen, as the launch of a vessel is only an incident of her construction, and does not alter the length of time taken to complete the ship if she is launched six months after she was commenced, or sixteen months afterwards. The real test is the number of tons built into the ship at the time of the launch. A telegram from France recently said that the rapidity of construction of British warships had already been beaten in the case of the *Iena*, constructed in seven-and-a-half months. The *Iena* is a battleship, displacing 12,050 tons, and was launched in about eight months from laying down with the weight of 3,580 tons. Against this it may be mentioned that the *Ocean* was launched at the end of sixteen months, and weighed at that time nearly 8,000 tons, and the *Implacable*, launched at the end of eight months, weighed 5,000 tons. The *Formidable*, which had been on the slip about the same time, when launched weighed 4,500 tons. And against the six months and twenty days which the *Suffren* will have been on the stocks, if she takes the water on the 25th, it may be mentioned that if the *Bulwark* takes the water at Devonport at the date fixed, three first-class battleships will have been launched from the same slip within 18 months. It will be a surprise if the *Suffren* weighs more than 4,000 tons when launched.

Devonport Dockyard.

There has been a great deal of work done lately at this yard in connection with the mobilising of the ships which are to take part in the Naval Manœuvres. There are quite a number of cruisers and torpedo vessels in the Fleet Reserve here available for commissioning, in addition to the ships of the Channel and Reserve squadrons. The cruisers *Juno*, *Æolus*, *Sirius*, *Thames*, *Cambrian*, *Charybdis*, *Pique*, and *Hermes*, the gunboat *Dwarf*, the torpedo-boat destroyers *Lynx*, *Bat*, *Thrasher*, *Locust*, *Osprey*, *Wolf*, *Leven*, and *Gipsy*; and the torpedo boats 45, 52, 53, 55, 57, 58, and 80 are all practically ready for sea. The battleships *Collingwood*, *Thunderer*, *Nile*, *Benbow*, and *Colossus*, and the cruiser *Melampus*, which are in commission in the western command as port guardships, have been lately docked and refitted. The *Magnificent*, *Arrogant*, *Furious*, *Niobe*, and *Pelorus* have all been docked and refitted prior to mobilisation. There are some 3,000 men in the Royal Naval Barracks here, and a good number going through the gunnery and torpedo courses on the *Cambridge* and *Defiance*. Great progress is being made with the *Bulwark*, which has now been in hand a little over three months and the *Implacable* and *Ocean* battleships, the *Hermes* and *Highflyer* cruisers, the *Dwarf* gunboat, and the *Gipsy*, *Leven* and *Wolf* torpedo-boat destroyers are all receiving a good deal of attention. The delay which has been experienced lately in the completion of the *Implacable* would not have happened had the ship's armour been delivered from the contractors at the proper time. The Navy League visited this dockyard a week or so back, and were shown over the workshops and smitheries and various vessels in the docks and basins. It will interest many to know that Sir William White is to visit Devonport this month, and is to be presented with the freedom of the City. He is to open some new technical schools.

The Coal Used by the Victorian Naval Defence.

A most interesting report on the coal used by the torpedo-boats of the Victorian Naval Defence Force was recently sent in to the secretary of this organisation, and has just appeared in print. The report is made out by Lieutenant F. Tickell, in command of the turret ship *Cerberus*, and deals with the results attained when the torpedo-boats of the colonial defence, the *Countess of Hopetoun* and her sisters, were using the Gippsland coal supplied by the Victorian Government. Lieutenant Tickell considers that the coal is unfit for use during active service on account of the dense smoke and flame which pours from the funnels on the fans being used to create a forced draught. Not only would this expose the boat to instant discovery, but he asserts that when using this coal the boats cannot maintain the maximum of speed after even a few minutes, whilst on a run of a few miles not more than two-quarters speed can be kept up. A torpedo-boat using this coal could not evade detection at night, and as the value of these boats depends upon their not being observed, other coal—or means of burning the Gippsland coal—will have to be resorted to. Lieutenant Tickell suggests that some of the best Welsh coal be imported to Victoria for the use of the torpedo-boats whilst on active service. But before this extreme step is resorted to, a mixture will probably be tried of Victorian and New South Wales coal. Of course it may not be the coal which causes the smoke and flame as much as bad combustion, but this question ought to be enquired into before the expense of taking coals from Wales to Victoria is incurred.

Building up the German Navy.

The launch of the new German battleship *Kaiser Wilhelm der Grosse* has once more directed attention to the efforts which are being made by Germany to build up a fleet which shall be equal to at least one of her rivals on the sea, France or Russia. The German Emperor, as usual, made a speech which was of great interest to report on the occasion. The *Kaiser Wilhelm der Grosse* is 383 ft. in length, with a beam of 68 ft., a mean draught of 26 ft., and a displacement of 11,081 tons. Her armament consists of four 10 in. guns in revolving turrets, twelve 6 in. quick-firing guns in armoured casemates, six 6 in. quick-firing guns in revolving turrets, twelve 3·4 in. quick-firing guns, twelve 1·34 in. and twelve machine guns. The torpedo armament is to consist of one 21 in. submerged bow tube, four 18 in. submerged broadside tubes, and one 18 in. above-water stern tube. The vessel is fitted with three triple-expansion engines in watertight compartments, capable of developing 13,000 H.P., and calculated to produce a speed of 18 knots. The normal coal-carrying capacity is 650 tons, which can be increased to 1,000 tons. The protection consists of an armour belt 6 ft. 8 in. in width, with a thickness of from 6 in. to 12 in. along the forward four-fifths of the vessel. The stern section is, for the sake of lightness, only protected by a 3 in. curved armour deck. Elsewhere the armour deck is only 2½ in. thick, and rests on the upper edge of the armour belt. The time given for the German naval manœuvres this year is from the middle of August to the middle of September, and the following is the force which will take part:—The battleships of the first squadron, the second squadron, which latter will be formed with armoured cruisers, the division of armoured gunboats of the reserve, two flotillas of torpedo-boats, the training ship *Blucher*, the small cruisers *Wacht*, *Hela*, *Blitz*, *Greif*, *Grille*, *Zieten*, and *Pelikan*.

Chatham Dockyard.

About the time these lines go to press the new cruiser *Pioneer* will have been floated out of dock, as the date fixed was the 28th ult. In connection with the launch of the *Venerable*, now building at this yard, it is rumoured that an effort will be made to have the launching ceremony performed by Princess Victoria of Schleswig-Holstein. The launch will take place about the end of September next. The *Venerable* is the longest and heaviest battleship ever constructed at this yard. She is to be hurried forward as much as possible, in order that a new battleship may be commenced on the slip she will vacate. As regards the two battleships *Goliath* and *Irresistible*, completing here, there is little to be said except that they are making good headway. The *Irresistible*, although not so far advanced as the *Goliath*, has a number of her armour-plates in position. The *Goliath*, on the other hand, has all her guns on board and in position, whilst she has received her engines and the 20 Belleville water-tube boilers allotted to her. It is expected that in a few days the preliminary trial of her engines will be completed. It is expected that they will produce 13,500 H.P., with a speed of 18½ knots under natural draught. They were supplied by Messrs. Penn. A new naval hospital is to be commenced about a couple of miles from this dockyard, as the accommodation at the Royal Naval Hospital is at present inadequate. The new building and site will cost about £300,000, and accommodation will be provided for 600 beds. Good progress is being made with the new naval barracks, but it is not expected that they will be ready for habitation for another two years. Every available hand was turned on to the ships of the Channel Squadron, which had been sent to this yard to have their defects made good. These were the *Repulse* and *Jupiter* battleships, and *Diadem*, *Furious*, and *Pactolus* cruisers. A great deal of extra work has been occasioned by the preparation of vessels which are to take part in the coming manœuvres.

A Royal Naval Tournament.

The suggestion has been made in several papers recently that a Royal Naval Tournament should be held in London each year in the same way as the Royal Military Tournament is held at Islington, the proceeds, of course, to go to naval charities. The only objection which the various writers cannot overcome with their pen is that a large enough piece of water cannot be obtained in London to admit of an adequate representation of the life and duties of our men-of-war's men. After all it does not seem such a great difficulty, for there are many large commons around London containing good-sized ponds which could be adapted to suit the needs of such an exhibition—the Long Pond, on Clapham Common, for instance. Taking the pond from the main road, a model of a battleship might be erected at the right-hand end, whilst at the left-hand end, leaving a good space of grass between the first row and the water, a great number of rows of seats could be erected, the whole place, of course, to be covered in. On the model of the battleship the seamen could give exhibitions of that part of their duties which would most interest the sightseers, whilst on the water boat-work could be shown, and demonstrations given on the grass of how a landing party comes ashore to fight. One of the writers remarks very truly that a man-of-war's man's drill is not merely confined to handling small guns ashore and exercises at cutlass and rifle drill :—"His activity at all sorts of work, swarming up a mast, lowering boats, serving big guns, and much else would, if exhibited at the Agricultural Hall, carry the town by storm. The sailors would show how torpedoes are launched from shipboard; submarine diving, and the method of saving life at sea by the rocket apparatus, would be a sure draw."

The Trials of the "Hermes."

Special interest attaches to the trials of the second-class cruiser *Hermes*. The *Hermes*, it will be remembered, belongs to the Estimates of 1896-97, together with her sisters the *Highflyer* and *Hyacinth*. The vessel displaces 5,000 tons, and, with 10,000 I.H.P. at natural draught, was intended to steam at 21·5 knots. She is fitted with two sets of four-cylinder triple-compound engines and Belleville boilers, of which there are eighteen. Her first run of thirty hours, with an I.H.P. of 2,099, showed a speed of 13·4 knots, the coal consumption per I.H.P. being 2·32 lbs. This was followed by two runs of twelve hours' duration with an I.H.P. of a little over 1,000, and a speed of 10·5 knots, the coal consumption varying from 2·31 lbs. to 2·61 lbs. The *Hermes* also underwent a second thirty hours' trial, on which a speed of 18·8 knots was obtained, with an I.H.P. of 7,712, the coal consumption being 1·57 lb. per I.H.P. per hour. On her eight hours' full-power trial a speed of 20·5 knots was obtained, with a total I.H.P. of 10,224. Although the Admiralty were satisfied with the speed and engine power attained on these occasions, the contractors were requested to repeat the thirty hours' trial at an I.H.P. of 2,000, as the coal consumption on the first occasion was in excess of that stipulated for in the conditions of contract. This trial took place, and the result was that the coal consumption worked out at 1·78 lb. per I.H.P. per hour, instead of 2·32 lbs. The remaining trials were all satisfactorily completed.

Sheerness Dockyard.

There is very little of importance to chronicle about this yard. The various vessels building and completing are all receiving their proper share of attention, as well as several vessels which have been sent here to have their defects made good, or to be refitted. The steam trials of the *Prometheus* have, as expected, proved successful in every way. She is fitted with the Thornycroft type of water-tube boiler, like her sister ships the *Proserpine* and *Perseus*. She first of all carried out a 30 hours' coal-consumption trial at 3,500 I.H.P. The vessel should have been delivered nearly twelve months ago, but the dispute in the engineering trade and various experiments with her safety valves have kept her in the contractors' hands until a few weeks back. The check which the *Pomone* met with during the progress of her commission trial proved to have been caused by nothing more than a leaky cylinder cover. Her sister ship the *Pyramus*, it is reported, passed through the whole of her contractors' trials in a successful manner. The sloops *Vestal* and *Sheerwater* will probably be floated out in November or December next, when the two new sloops mentioned in this year's Naval Estimates will be commenced. The *Basilisk*, which arrived home about three weeks ago, is to undergo an extensive refit without loss of time. This refit should be completed by the coming October The *Wye*, storeship, is now being prepared for her departure on the 14th inst. to Rio de Janeiro.

The Pay of Engineer Officers Abroad.

In a recent number of the *Globe*, the naval correspondent of that paper points out some extraordinary differences in the amount of pay received by the various engineer officers in charge of factories abroad. His figures are taken from the Navy Estimates. He points out, for example, that the inspector of machinery at Garden Island, Sydney, heads the list with £963 a year, and considers that, although this is not a sixpence too much, this officer is a very lucky man when it is remembered that he enjoys excellent society and a healthy climate. The inspector of machinery at Bermuda comes next, he having £831 per annum, unless, as is probable, the inspector of Hong Kong gets more pay than any of them. Next to him, however, is the chief engineer of Hong Kong Dockyard, who has a modest salary of £732 a year. Passing over the establishments at Malta, Cape of Good Hope, Gibraltar, and Esquimalt, the chief engineer at Jamaica actually gets £311, against £327 that is received by the engineer in charge at Halifax. Considering the amount of responsibility attaching to such a post as is held by the chief engineer at Hong Kong and Halifax, the *Globe's* correspondent is perfectly correct in considering the inspector of machinery at Garden Island, Sydney, a very lucky man.

The Peace Conference and the Red Cross at Sea.

The Peace Conference has at last achieved its first result. This is the adoption of the ten additional articles to the Geneva Convention, adapting it to naval warfare, drawn up by the Red Cross Sub-Committee. There is no question that the fleets of the various Powers should have a certain number of hospital ships in attendance upon them in time of war.

The present force with which a warship is provided to look after its maimed and wounded is quite insufficient for the number of officers and men who are sure to require attention as the result of a sea fight. Vessels purporting to be hospital ships, visiting the scene of hostilities, must of course have their status clearly defined. It was proposed by the Conference that neutral vessels desirous of rendering aid to the wounded or distressed crews of disabled ships should fly the flag of one of the belligerents. This would mean that certain hospital ships only intended to assist the vessels flying the same flag as themselves, and it is possible that if they interfered, or went to the assistance of disabled or partially disabled vessels before these ships had surrendered, the opposing squadron might resent the interference in a very disagreeable manner. One of the delegates expressed the belief that the Continental Powers would make use of the floating hospitals sent out by "societies of succour recognised by the signatory Governments," whilst this country would depend upon nobody's beneficence, but would equip its own hospital ships. It will be interesting to know the exact details of the ten additional articles to the Geneva Convention which have been agreed to.

Pembroke Dockyard.

The completion of the Royal yacht *Victoria and Albert*, is being proceeded with as rapidly as possible. All her machinery has now been lifted on board, as well as her foremast. The other two masts would also have been put in position if the delivery of some of her rigging had not been delayed. There is not much to be said concerning the armoured cruiser *Drake* which is undergoing construction here, except that as many hands as possible are at work upon her. The new cruiser *Essex*, which is to be laid down here, will resemble the *Drake* in many particulars, especially as regards the protective decks. No. 5 slip, on which the *Essex* will be built, is to be lengthened shorewards. The new sick quarters for Devonport, mentioned in the Navy Estimates, are to have about £2,000 spent upon them this year, although the total cost is to be some £12,000.

From the Lower-Deck to the Quarter-Deck.

The question of the advisability of permitting seamen to rise from the lower-deck to responsible positions on the quarter-deck has been raised by an article in the recent number of the *Saturday Review*, which has special reference to the want of engine-room artificers for the Navy. The writer says that there seems to be some difficulty in securing the services of a sufficient number of skilled artisans for engine-room artificers in the Royal Navy, whilst those who have entered desire an improved position. It appears that no provision exists by which a select few of these men can rise to officers' rank and become engineers. "May not this," he remarks, "deter many from adopting a career which otherwise appeals to them?" It may deter a few, but the writer should have known that the majority of artisans who enter the Navy as engine-room artificers know absolutely nothing about a warship before they make up their minds to enter her Majesty's Navy, and it is only after they have been in the service for a great number of years, and have risen to the top of the ladder in the department in which they are serving, that they have any longing to become engineer-officers. An engine-room artificer, before he enters the Navy, is probably earning his living as an engineer in a big firm on shore, and is affiliated to the Amalgamated Society of Engineers. In this position he has under him a labourer, a man who has not served his time as an apprentice, but yet knows almost as much as the engineer. In a union shop, if this labourer attempted to do the work of a trained engineer, every one of the latter would at once cease work. Thus the engine-room artificer, who wishes to be an officer, is in much the same position towards the commissioned engineer-officer, who has spent years and years studying at Keyham College, as the labourer was to himself before he entered the Navy. He will not permit the labourer to rise to the position of engineer any more than at present engineer-officers would permit artificers to assume commissioned rank. The writer should also bear in mind that almost every engine-room artificer lives on the money he earns at his trade, and that very few naval officers, whether engineer or executive, are able to do this. It is only twelve months since the engine-room artificers obtained warrant rank, and there will be plenty of time to talk of giving them commissioned rank when they have been on trial a little longer. The writer in the *Saturday Review* says that the custom of allowing seamen and artisans to become commissioned officers has been found to work well in the French Navy. Perhaps he will name some instances.

The Naval Manœuvres.

On the 11th of this month, if we have been informed aright, the Naval Manœuvres of this year commence, and the ships of the Channel Fleet and Fleet Reserve are now all busy preparing for sea. It is not as yet known what the scope of operations is likely to be, but it is stated that as many torpedo-boat destroyers as possible are to be put into commission to take part in the operations. If this is so, it would seem to indicate that scouting is to be a principal feature of the manœuvres, and that torpedo-boat destroyers are to be used for this purpose because of the rapidity with which they can approach or retire from a hostile fleet to get and bring back valuable information. As regards the men who are to take part in the mobilisation, it is doubtful if all the ships which are commissioned will have a full crew in spite of Mr. Goschen's optimistic utterances on the subject. As regards mechanics, there is a lamentable deficiency, so that altogether it may be expected that some of the newly commissioned vessels will feel the want of men very badly.

ENGINES OF S.S. "MANCHESTER CORPORATION."

IN our page plate supplement we show a part front and part end view in perspective of the engines which have been built by Messrs. Sir C. Furness, Westgarth & Co., Limited, of Middlesbrough, for the new steel screw cattle and cargo steamer named the *Manchester Corporation*, built by Messrs. Furness, Withy & Co., Limited, at their Middleton shipyard, West Hartlepool, to the order of the Manchester Liners, Limited, of which Sir Christopher Furness is the chairman.

As will be seen from the illustration, the engines are of the inverted triple-expansion type, having cylinders of 28 in., 46 in., and 78 in. diameter respectively, and a stroke of 54 in. operating three cranks. The high-pressure cylinder valve is of the piston type, and the intermediate and low-pressure cylinders have double-ported slide valves. An auxiliary starting valve is fitted to the intermediate cylinder. The low-pressure piston only has a tail rod, and the low-pressure slide valve a balance piston. The connecting rods, which are of best forged scrap iron, are 9 ft. 6 in. long between centres. The valve gear is the ordinary link motion, with a double bar link, all parts are fitted with adjustable brasses, and the rods are supported in adjustable guides.

The reversing gear is of the type having an all-round motion so that it cannot be overrun or damaged, the reversing levers on the weigh shaft being provided with suitable means for notching up each engine separately. A turning engine is fitted on the after end, which gears by a worm into a worm wheel, and is adapted to turn in both directions. The cylinders of the main engines are supported on cast-iron columns, the front having single feet and the back having double feet. The condenser, which is circular, is of cast iron, and is supported on brackets on the back columns. The total cooling surface is over 4,000 square feet, the water circulating twice through the tubes. The ballast pump is arranged to pump through the condenser when desired.

One single-acting air pump is provided, it is placed at the back of the low-pressure engine, and is worked by steel levers operated from the low-pressure piston rod crosshead.

The circulating water is dealt with by one centrifugal pump, having two engines, either of which will drive the pump. This pump is fitted with connections for pumping out the balance tanks overboard without passing through the condenser.

Two single-acting feed pumps are bolted to the air pump hot well, and are worked by the air pump crosshead, so that, if one end of the crosshead should become disabled, the other pump will still be serviceable; and cocks and valve sare fitted so that the pumps can be worked separately and that either pump can be overhauled without stopping the other. In addition to these pumps in the main engines, a pair of Weir's patent direct-acting brass-fitted feed pumps 9 in. diameter and 21 in. stroke are provided.

Two single-acting bilge pumps are also fitted on the hot well and are worked and arranged in a similar manner to the feed pumps.

The crank-shaft is of good forged iron and is built up in three interchangeable elements. The angle of the cranks to one another is equal, the high-pressure crank leading. The diameter of the shaft is 16 in. and that of the crank 16 in. also, with a length of 17 in. The propeller shaft in 17 in. diameter and is covered with brass casing, an indiarubber ring being provided between the propeller and the end of the brass liner to prevent corrosion. The tunnel shafting is of iron 14½ in. diameter, increased to 14¾ at the bearings.

The thrust-block has horseshoe collars lined with white metal, and the thrust-shaft collars run in an oil bath.

The propeller is of cast iron and has four detachable blades.

The boilers are three in number and are single-ended, they have a mean diameter of 14 ft. 9 in. and are 12 ft. long over the tube plates. The tubes

THE NEW
PUBLIC LIB

are wrought iron lap-welded, and 2½ in. diameter and 8 w g thick. The water space between the tubes is 1¼ in., and the length of the tubes between the tube plates is 8 ft. 3 in. The boilers have each three furnaces 3 ft. 10 in. in diameter, of the suspension type, and are arranged with 5 in. water spaces between. They are designed for a working pressure of 190 per square inch.

Howden's system of forced draught is fitted to the boilers, the draught being produced by one double inlet fan 84 in. diameter driven direct by two engines 7 in. diameter. The funnel is 9 ft. diameter, and is taken up about 80 ft. above the fire bars.

The I.H.P., for which the engines have been designed is 3,000 at 70 revolutions per minute.

ELECTRICAL NOTES.

(From our own Correspondent.)

Marconi's system of wireless telegraphy was under test again, and a record result was obtained. The distance which the waves were sent was in this last case 28 miles, and no difficulty was experienced in the reception of the messages. M. Marconi is on his way to the United States to superintend the fixing up of the apparatus for his system to be in use in the international yacht race. One set of apparatus will be on board the *Columbia*, and the other on shore. The records of the race will thus be chronicled as in the regatta at Dublin.

Cantilever Electric Crane.—Three cranes are under construction for the William Cramp & Sons' Ship and Engine Building Co., Philadelphia, and one of them has just been put in operation. It is driven by a single electric motor of about 150 H.P., of the Elwell Parker type, and built at their works, Cleveland. The crane is mounted on a steel trestle, which runs alongside the ship under construction. The travel of the crane along this trestle is 725 ft., and the underside of the cantilever is 92 ft. from the ground. Its lifting capacity is 15 tons at 60 ft. out on either arm, and five tons at 95 ft. The total length of the cantilever arms in all is 202 ft. The gauge of the track along which the crane runs is 20 ft., and the crane has a speed up and down the trestle of from 500 to 700 ft. per minute against the wind. It hoists its maximum load 125 ft. per minute, or five tons 350 ft. per minute, or 1,000 pounds 700 ft. per minute, and the trolley can travel along the cantilevers at 800 ft. to 1,000 ft. per minute. It covers two battleships. At present there is on its right side a 13,000-ton battleship for the Russian Government, and on the left is the keel of the new battleship *Maine*.

Electrical Ventilating Fan.—The Sturtevant Co., New York, are putting much care into the construction and improvement of electrical fans. The wheel consists of eight blades secured to a hub, and held in their relative positions by a hoop at the periphery. The temperature rise of the motor after 10 hours' run is 27 to 30 degrees Fahr., against 60 degrees to 80 degrees frequently met with in practice. The design of the motor has been made to fulfil the following conditions: (1) The production of a magnetic field of the greatest possible quantity in proportion to the rated horse-power. (2) The excitation of this field with the least possible consumption of energy. (3) Suitable material for poles to eliminate eddy currents, and heat less therein. (4) Pole pieces of such design as to prevent distortion of magnetic field by armature flux, and the consequent low reduction of the self-induction of the armature coils. (5) Arrangement of magnetic circuit so that the leakage is small. (6) An armature in which the core and resistance losses are reduced to a minimum. In a 1-2 Kilowatt 500-volt motor, an efficiency of 30 per cent. was obtained when running 1,300 revolutions per minute, and a load of 175 per cent. can be carried with no sparking at the brushes. They are built of the two-pole type from ¼ to 3 H.P., and multipolar from 3 to 20 H.P. The fans are from 18 in. to 120 in. diameter.

Maxim Direct-Coupled Generator Set.—There is a very excellent and compact set consisting of a Lundell generator driven by a Forbes-Maxim type engine. It is rated at eight kilowatts when running at a speed of 500 revolutions per minute. It is fitted in the steam yacht *Postmaster General*, which is doing duty in New York Harbour. It is capable of developing 10·8 kilowatts, and did so in trial sufficient to supply 216 lamps. The total weight is 1,050 lbs., or about 100 lbs. per kilowatt output. The space required for the installation is 27 in. wide by 6 ft. 2 in. long, the height being 38 in. The armature is series-wound, and a single field coil is used, which magnetises all the different field poles to the same degree by intensity.

The Nernst Electric Lamp.—The new thing in electric lamps is this one which has been brought under public notice in England by Mr. Swinhorne. Refractory oxides are worked up into little rods, and these are rendered incandescent by sending a current through them. The rods are united in two platinum wires, by means of paste made of refractory oxides, and these rods, although good insulators when cold, become conductors when heated. Resistance falls with increase of temperature, and increase of light rises with increase of current. This tendency is corrected by a series resistance of fine wire amounting from 10 to 12 per cent. of the whole resistance of the lamp The necessary electric energy is 1·5 watts per candle for large lamps and 1·6 for small ones. It is evident that, like the oil engine, a starter is required, since the rods are insulators when cold. These rods have therefore to be heated with a lamp or match to begin with, or they may be heated with a heating resistance placed near the rods. A 16 c.p. incandescent lamp requires about 60 watts per hour; the Nernst lamp requires about $16 \times 1·5 = 24$ watts. It requires also less watts per hour than an equivalent arc light.

Electric Pumps for Canals.—In dry seasons the supply to the high-level reaches of the Bourgogne Canal are deficient, and electrical pumping plants have been provided at the different locks to raise water from the low to the high levels during these seasons. There is a waterfall near the canal and this has been utilised to transmit power to the pumps. The system is three-phase current at 2,000 volts. Centrifugal pumps driven by motors on the same axles are used to raise the water. The pumping of the water costs one-tenth what it would cost to provide extra water in the main reservoirs.

Candle power for candle power the arc light is run at much less expenditure of electrical energy than the incandescent light, and as a substitute for the expensive incandescent lamp **Messrs. Johnston & Phillips** introduced the midget arc lamp, which used a very small current indeed. We do not know how far this small arc lamp has been successful, but they now make a speciality of a lamp which they call the "Well," of a very efficient kind. This lamp is made both for alternating and continuous current, and for any potential. It has one advantage which will appeal to most, namely, its extremely low price, £5, for single lamps, and it is reliable. To obtain the soft diffused light special globes are used, and the light given is about 2,000 candles per 500 watts. The life of the carbons is almost as long as that of the filament of an incandescent lamp. Lamps which are in parallel, and series using four amperes, have a carbon life of 220 hours, and they thus burn about twenty times as long as the ordinary type lamp. The maximum rays from the lamp come out at about 25 degrees downwards, measured from the horizontal, and there is thus a distribution of light at long ranges, whilst the light beneath the lamp is quite abundant. Practically the only moving part is the armature, which is held in suspension whilst the lamp is burning. The cost of burning is said to be very low, and works out at one-eighth of a penny per 500 candle-power, which is eight times better than that claimed for the cost of incandescent gas lighting. There are some 17,000 of these lamps in use.

The Broadheath Works of the Linotype Co., near Manchester, have followed in the wake of Messrs. J. & G. Weir Cathcart, and are remodelling their shops with electric motors. The machine tools are run from shafting driven by motors of 5 or 10 H.P. Tests have been made with the separate shafts and motors. One a 2¼ in. shaft, 93 ft. in length, in ten bearings, required ·42 H.P. at 200 revolutions per minute, or ·042 H.P. per bearing, and a similar shaft required ·052 per bearing. The power of the shops is 75 kilowatts, and the efficiency of the generating plant 80 per cent., the running cost is ·94d. per B.T.U. Both lighting and power are supplied from the same generating plant.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from May 25th to June 24th, 1899:—

Barr, E., engineer to the *Duke of Wellington*, for the *Canopus*, to date May 27th.

Bishop, T. H. B., engineer to the *Pembroke*, for the *Dasher*, undated.

Bryan, R., engineer to the *Vivid*, for the *Ocean*, to date May 30th.

Coad, H. J., engineer, to be chief engineer in her Majesty's fleet.

Coopper, H., engineer to the *Duke of Wellington*, for the *Chamois*, to date June 7th.

Cottam, F. W., staff engineer to the *Pembroke*, for the *Astræa*, to date June 5th, and for recommissioning, to date June 15th.

Dart, F. H., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Green, R. W., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Griffin, D., fleet engineer to the *Pembroke*, for the *Immortalité*, undated.

Hart, A., chief engineer to the *Pembroke*, for the *Vindictive*, to date June 5th.

Huddy, J. B., engineer to the *Vivid* (supernumerary), to date June 12th.

Irish, H. W., engineer to the *Victory*, for the *Lightning*, to date June 9th.

Johnson, C. H. (probationary), assistant engineer to the *Repulse*, to date June 12th.

Kempt, A. C., assistant engineer to the *Renown*, to date May 27th.

Kirwin, J. J., assistant engineer to the *Vivid* (supernumerary), to date July 1st.

Larg, A. D., assistant engineer to the *Renown*, to date June 12th.

Lawrance, W. W., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Lawton, W. R., engineer to the *Duke of Wellington*, for the *Ranger*, to date June 9th.

Lumsden, W. G. G. P. (probationary), assistant engineer to the *Edgar*, lent, undated.

Martell, P. D., engineer to the *Victory*, for the *Fawn*, to date June 7th.

Meadus, H. H., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Moore, C. A., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Owen, R., engineer, to be senior engineer R.N.R.

Page, F. J., engineer to the *Vivid* for the *Fervent*, to date June 22nd.

Parnall, W. R., assistant engineer to the *Vivid* (supernumerary), to date July 1st.

Pearce, W. W., engineer to the *Vivid*, for the *Lynx*, to date June 13th.

Pethick, E. E., assistant engineer to the *Nile*, to date May 27th.

Reynolds, J. A., engineer to the *Pembroke*, for the *Basilisk*, undated.

Shattock, T., engineer to the *Edgar*, lent, undated.

Sillince, W. P., assistant engineer to the *Duke of Wellington* (supernumerary), to date July 1st.

Thompson, G. F., engineer to the *Duke of Wellington*, for the *Conflict*, to date May 27th.

Toop, W., engineer to the *Vivid*, for the *Lynx*, undated.

Toop, W., engineer to the *Vivid*, for the *Opossum*, undated.

Turner, W. F., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Webster, G. P., engineer to the *Vivid*, for the *Zephyr*, to date June 22nd.

At a recent meeting of the Clyde Steam Ship Owners' Association, the committee elected Mr. Hugh Gibb (of Messrs. Cayzer, Irvine & Co,) and Mr. George Sloan (of Messrs. Wm. Sloan & Co.) to represent the Association upon the Board of *the British Corporation for* the Survey and Registry of *Shipping*.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

WHILST great briskness continues to characterise operations in the shipyards and engine shops of the Clyde, as evidenced by the large number of launches and trial trips, the past month has seen no improvement, but a much more accentuated cessation, in the placing of new orders. Not one of any importance has been recorded up to the date of writing—24th ult.—and if any have been booked the builders have kept their own counsel remarkably well. Enquiries are not unknown, but these are more in the nature of "feelers," and owners who contemplate adding to their fleets prefer to wait uncommitted—although good delivery is not now so impossible a matter—until the prices of materials are somewhat less than they are.

One of the trade sensations of the month has been the failure of Messrs. Neilson Brothers, the well-known iron and steel merchants, of Glasgow. A statement of affairs was submitted at a meeting of the principal creditors, held on the 6th ult., and this showed liabilities amounting to £150,791, and assets amounting to £22,713, which leaves a deficiency of £128,078. The principal creditors and the amount of their claims are as follow:—The Dowlais Iron & Steel Co., South Wales, £21,754; Messrs. Harland & Wolff, Belfast, £21,713; Vickers, Sons, & Maxim, Barrow, £15,589; Clydebank Engineering & Shipbuilding Co., £9,926; Fairfield Shipbuilding & Engineering Co., £6,318; W. Beardmore & Co., Parkhead, £6,195; Glasgow Iron & Steel Co., £5,764; Arroll Brothers, Glasgow, £4,491; Workman & Clark, Belfast, £4,896; Charles Connell & Co., Glasgow, £4,716. Amongst the secured creditors are the Royal Bank of Scotland for £24,237; Mr. Robert Mackill, shipowner, Glasgow, for £16,293; and Messrs. Holms-Kerr & Hedderwick, accountants, for £14,839. The trade accounts amount to £53,335; claims for unfulfilled contracts, £86,710; and the balance is made up of small accounts. A committee, representing the principal shareholders, have investigated and reported on the state of affairs submitted, and recommended the acceptance of 2s. in the pound.

With the beginning of the month rumours and statements, claiming more or less to be well authenticated, began to be circulated as to an amalgamation between an important Clyde shipbuilding firm and one of the great Sheffield steel-working and armour plate-making concerns. After corrections as to these rumours and statements being "premature and unauthorised," subsequent events soon proved that, whilst perhaps unauthorised, the statements had solid fact behind them, and that the great concerns to be combined were those of the Clydebank Shipbuilding & Engineering Co., Limited, and Messrs. John Brown & Co., Limited, Sheffield.

The first explicit and official announcement made with regard to the matter—which, as can well be understood, excited from the first very great interest throughout Clydeside engineering and commercial circles—was contained in the annual report of Messrs. John Brown & Co., published on the 13th ult., in the course of which it was stated that "a favourable opportunity has arisen for strengthening the business of the company by the acquisition of one of the best equipped and most successful shipyards and engineering works in the United Kingdom. A provisional contract has been made with the Clydebank Engineering & Shipbuilding Co., Limited, for the purchase of their property and business as a going concern on terms which the directors consider to be favourable to the shareholders."

The necessary resolutions for carrying out the above arrangements were proposed and carried at the general meeting of the Sheffield company held on the 22nd ult. From these it transpires that the arrangement involves:—The purchase of the whole of the property, business, and goodwill of the Clydebank company, and the undertaking, carrying out, and fulfilment of that company's liabilities, contracts, and engagements; the carrying on of the business of shipbuilders and shipowners, dock and wharf owners, and dealers in all materials and things required or usable in the building, fitting, armament, equipment, and repair of vessels of every kind, whether vessels of war or for merchant service; the carrying on of the business of mechanical engineers, including the manufacture of, and dealing in, marine or other engines, stationary or locomotive boilers, ordnance, guns, and other weapons, arms of all kinds, armour plates, shells, shots, projectiles, ammunition and targets, and all accessories thereto respectively; the increase of the nominal capital of the company to £2,500,000, by the issue of 48,000 preference shares of £10 each, to rank *pari passu* with the existing preference shares, and 500,000 ordinary shares of £1 each; the subdivision of the original capital of the company of each ordinary share of £20 upon which £15 has been paid into 20 shares of £1 each, upon which 15s. shall be credited as paid up.

The firm of Messrs. John Brown & Co., Limited, was established in 1864, and the capital consists of £1,250,000 in ordinary shares of £20; £270,000 in 5 per cent. preference shares of £10, and loans at 3 to 4½ per cent. to the amount of £263,045. The concern for the last 15 years at least has paid dividends ranging from 5 to 7½ per cent., the dividend for the last financial year having been 10 per cent. on the ordinary shares of the company. The Clydebank Engineering and Shipbuilding Co., Limited, was registered in 1890 to take over the business of the firm of James & George Thomson. The authorised share capital was £250,000 in shares of £10, all of which was issued to the vendors as fully paid. Mr. W. A. Donaldson, of Cochno, is chairman, and the other directors are:—Messrs. J. R. Thomson, J. G. Dunlop, A. S. McClelland, J. P. Smith, and G. P. Thomson. Not counting the vessels launched this year, the number of vessels of all kinds built at Clydebank has been 165, of which 116 were merchant vessels, and 49 vessels of war, 28 of the latter being for the British Government. The largest merchant vessels produced were the *Paris* and *New York*, each of 10,700 tons, and the largest warship the *Jupiter*, of 14,900 tons displacement.

Scott's Shipbuilding and Engineering Co., Limited, which, as recorded in last month's Notes, is the new joint-stock title of the firm formerly, and for a very long period, known as Messrs Scott & Co., Greenock, have recently built handsome new offices, and an extensive block of shops, including those for joiners and carpenters and for mould loft purposes, and in other ways are equipping themselves for undertaking a larger amount of work than ever. In view of the changed title, it is of interest to place on record that Messrs. Scott & Co. claim to be the oldest shipbuilding concern in the United Kingdom. Some years ago, in writing to a shipping journal correcting some misstatement as to the age of the firm, Messrs. Scott & Co., said:—"The great-great-grandfather of the present partners of our firm commenced the business of shipbuilding at Greenock in the early years of last century. This business has been carried on here from father to son for five generations without intermission. During the period of nearly 200 years every partner of the firm has been of the name of Scott, and a lineal descendant of the founder. We may add that the marine engineering business established in 1824 by their grandfather, in connection with his shipbuilding firm, under the style of Scott, Sinclair & Co., is still carried on by our present partners at the Greenock foundry." It is about 50 years ago that this business was placed under the same control as the shipbuilding concern.

About 10 years ago the firm, to meet the demands of increasing business, purchased the iron shipbuilding yard, wood-yard, and graving dock in Greenock so long occupied by the firm of Steele & Co.; and, as showing the amount of work turned out by the Messrs. Scott, it may be stated that, from the taking of the extensive premises mentioned, the total output of steam and sailing vessels has been 170,000 tons. Among the numerous important orders the firm have at present on hand are several large cargo steamers for the Ocean Steamship Co. of Liverpool, for whom they have all along built extensively, and a large palatial steam yacht of 1,800 tons for Mr. A. J. Drexel, of Philadelphia, from the designs and specifications of Messrs. G. L. Watson & Co., Glasgow. This magnificent private steam yacht is 272 ft. long and 36 ft. 6 in. beam, and will cost, it is believed, £100,000. She will be the first yacht to be owned by an American under the recently adopted law, which requires him to pay entrance and clearance fees at every port in the United States which his yacht visits, the same as any other foreign merchant vessel owner.

Messrs. Chambers Brothers, launch builders, Greenock, have received another order from Messrs. Harland & Wolff, Belfast, for six of their patent collapsible lifeboats, which makes 18 for this firm alone. Messrs. Caird & Co., Greenock, have given an order for ten of the boats from Messrs. Chambers, who have 50 on hand at present.

At the Dalzell Steel and Iron Works, Motherwell, a record output in steel smelting has been attained of late with the three large 50-ton furnaces, which were started last year in No. 3 smelting shop. The record output for the last six weeks has averaged somewhat over 1,500 tons per week, and during the past eight months or so 500 tons of ingots per week have frequently been turned out per furnace. The production of the Dalzell Steel and Iron Works now runs to more than seventeen times the output of the original works in the seventies, this representing over 17,000 tons of finished steel and iron per month.

The management of the Steel Company of Scotland has recently undergone a change. Mr. A. McLellan, who has filled the post since the retirement of Mr. James Riley seven or eight years ago, having accepted the position of manager of the Carron Iron Co., Mr. W. Clark, who has occupied the position of secretary to the Steel Co. for a considerable number of years, has been appointed manager in his place.

In the early part of the month just closed the Dutch steam tug *Svaartee* arrived in the Clyde and took in charge, for towing to Rotterdam, the Anchor liner *Devonia*, and some days thereafter a similar tug, the *Ocean*, arrived for the *Circassia*, a sister ship, both having been sold to Dutch owners. The *Ocean*, in entering the Gareloch, where the Anchor liners have been laid up for some time, got aground on Row Spit, but got off safely, and in due time departed again with her charge. The tugs themselves attracted some attention, being powerful-looking and well-equipped deep-sea towing vessels, 160 ft. in length, 30 ft. beam, and with bunker capacity of 600 tons. They were fitted with a large drum, controlled by a separate engine, which hauls in and pays out the towing hawser.

With the departure of the *Devonia* and *Circassia* from the Gareloch there will only be three vessels left in this well known haven for old or uncommissioned ships, these being the old Anchor liner *Utopia* (which, as will be remembered, was raised after being sunk a good few years ago), the *Waldensian*, and the *Alaska*, formerly of the Guion fleet. The last-named, however, will also soon be taking her departure, having recently been bought—it is believed for breaking-up purposes—by Mr. Thomas W. Ward, of Sheffield, the price paid being £17,500. The *Alaska* was the first vessel to which the term "Atlantic greyhound" was applied. Having a tonnage of 7,000 and proportionate power, and turned out from Fairfield in 1881, she created a record, and disputed for a time the premiership of the Atlantic with the Cunard and Inman liners. As such vessels go, however, she is now an "old stager." Her last service was the carrying home to Spain of some thousands of soldiers on the conclusion of the war with America.

The Clan Line Steamship Co., Glasgow, are gradually transforming their fleet from vessels of the ordinary type to those of the turret-deck type, and already of the 50 vessels, built and building, which comprise the fleet, as many as 16 are of the turret class. Messrs. W. Doxford & Sons, Sunderland, the holders of the patent, have built or are building all these vessels with the exception of two which were built at Barrow under an arrangement with the patentees. Messrs. Doxford have at present three turret-deckers on hand for the Clan Line, and five others will follow as speedily as possible. These range in length from 380 ft. to 450 ft. The Clan Co., however, have not altogether forsaken the ordinary type of steamer, for they have at present two building in Clyde yards—one at Messrs. A. Stephens & Sons', Linthouse, and the other at the yard of Messrs. Blackwood & Gordon, Port-Glasgow.

Messrs. Menzies & Co., engineers, shipbuilders, and ship-repairers, Leith—one of the oldest shipbuilding firms in the kingdom, and notable as having built, in 1837, the *Sirius*, which with the *Great Western*, was the first steamer to cross the Atlantic—have acquired the shipyard at Inverkeithing, on the Fifeshire side of the Firth of Forth, occupied until recently by Messrs. Cumming & Ellis. They purpose carrying on the work there of ship construction and repair as an adjunct and complement to the engineering part of the business at Leith. The demand at that port, in the matter of engine and boiler work, has been such as lately to cause the firm to double their shops and lay down a variety of the most efficient modern tools. This enterprising firm have bought the plant, machinery, and stock-in-hand at the Inverkeithing yard, and two trawlers in course of construction as well. They intend making a speciality of the building of trawlers and small cargo boats on their newly acquired premises. We understand that, in conjunction with their well equipped engine shops at Leith, the firm are now in a position to contract for the complete building of hulls and machinery, and have just received an order for two trawlers 120 ft. long, to be fitted with triple-expansion engines. The firm have two dry docks in which they conduct their ship-repairing work at Leith, and in addition there is a patent hauling-up slipway at Inverkeithing yard, suitable for the repair of smaller vessels.

The death took place at Helensburgh, on the Clyde, on the 31st May, of Mr. Robert Darling, manager, and to a large extent creator, of the fine fleet of passenger paddle-steamers owned by the North British Railway Co. plying on the Clyde. Previous to taking up duty in the Clyde district, Mr. Darling was secretary of the North British Packet Co. at Burntisland, on the Firth of Forth. On the company starting a steamboat service on the Clyde in connection with the railway service, Mr. Darling was given charge of the Clyde steamers. At that period the company only owned two vessels, but 16 years ago, when the fine railway terminus of Craigendoran was opened, the fleet was greatly added to. Under the fostering care and excellent management of the deceased the service grew in importance, and the fleet of steamers increased in numbers. Within the past two or three years the fleet has been augmented by the paddle-steamers *Talisman* and *Red Gauntlet*, which are among the fastest of their size on the Clyde, and it is a melancholy coincidence that in the same week which saw the demise of Mr. Darling there was launched from the yard of Messrs. A. & J. Inglis, Pointhouse, the paddle-steamer *Waverley*, the latest and largest, and intended to be the swiftest, of the North British fleet.

The *Waverley* is the only addition to the list of Clyde summer boats this season, and, if rumour may be believed, the other railway companies will require to build again if they are to keep ahead. The number of pleasure steamers on the Firth of Clyde is now very large, and a few figures may be of interest. There are 38 steamers in all, aggregating 12,911 tons gross. The Glasgow and South-Western Railway Co. own ten, of 3,677 tons; the North British Railway Co. nine, of 2,632 tons; the Caledonian Railway Co. ten, of 3,081 tons; Mr. David McBrayne two, of 958 tons; Captain John Williamson three, of 749 tons; Captain Buchanan two, of 566 tons; the Loch Goil and Loch Long Steamboat Co. two, of 494 tons; the Glasgow and Inverary Steamboat Co. one, of 466 tons; and the Glasgow Steamers, Limited, one, of 268 tons. The Glasgow and South-Western own the two biggest boats—the *Glen Sannox*, of 610 tons, and the *Juno*, of 600 tons—and they have also the highest aggregate tonnage. There are, of course, a large number of coasting screw-steamers, which sail from Glasgow, touching at the coast ports, but these cannot, properly speaking, be included in the Clyde summer passenger fleet.

The engineering section of the Glasgow International Exhibition, 1901, already promises to be well worthy of the Clyde as the head centre of marine engineering and shipbuilding. At their last meeting the Marine Engineering and Shipbuilding Committee had under consideration the arrangements connected with their department. These included a very large number of offers for appliances which will be required. Messrs. Penman & Co., Glasgow, offer to supply Lancashire boilers and water-tube boilers, and the latter class of boilers are also offered by Messrs. Babcock & Wilcox, Renfrew; Humphrey & Tennant, London; Stirling & Co., Edinburgh; Weir's, Limited, Cathcart Berry, Manchester, and other firms. It is estimated that the total steaming power required for the purposes of the exhibition will be about 5,000 H.P., and the committee have already received offers to supply more than that power These offers are really of exhibits on loan. It was resolved to have, if possible, separate iron chimneys for each maker's exhibit in order that the working of each exhibit may be shown separately. The committee have also received offers for motors, electric lighting plant, lamps, and indeed for all other appliances connected with the illumination of the building and grounds of the exhibition. They have received offers from a number of well-known firms for the supply of engines and dynamos, some of which will develop as much as 1,200 H.P. All these points were considered at the meeting, and they were postponed for further consideration, when fuller information will be laid before the committee.

In connection with this section it may be mentioned that the Institution of Engineers and Shipbuilders in Scotland are organising an International Congress, to be held in Glasgow in 1901, which will be conducted on similar lines to that which was held in Chicago during the World's Fair.

Very special efforts are being made by the committee to render marine engineering and shipbuilding a leading feature of the exhibition. Their intention is to have exhibits of models of ships, which will at a glance enable the visitor to grasp the many epochs of progress that have been made in the construction and working of vessels during the century. The models will be subclassed into passenger ships, cargo ships, men-of-war, yachts, &c. They will show the transition stages of conversion: from wood to iron and steel, from sail to steam, from paddle to screw, from single to compound engines, from compound to triple-expansion engines, and other interesting directions in which development has progressed. So far, the committee are confident of making this section an unspeaking history of the advances in every department. From the year 1860 that will be no trouble; but, to ensure completeness with respect to the period preceding, they have issued a circular to shipbuilders and shipping companies asking for information as to models that might be at their disposal. The committee are also arranging with the Clyde Trustees for that body to show clearly the results of their work on the Clyde by means of models of the river, representing it as it existed in the year 1800 and as it will be in 1900. These will be made to show also the increase in the area occupied by shipyards and engine works and in the growth of docks, wharfage, &c. The engineer and electrician for the exhibition is Mr. Thomas Young, C.E., Glasgow, who held the same important post during the exhibition of 1888, as well as at other international exhibitions in Edinburgh and Newcastle.

THE TYNE.

(From our own Correspondent.)

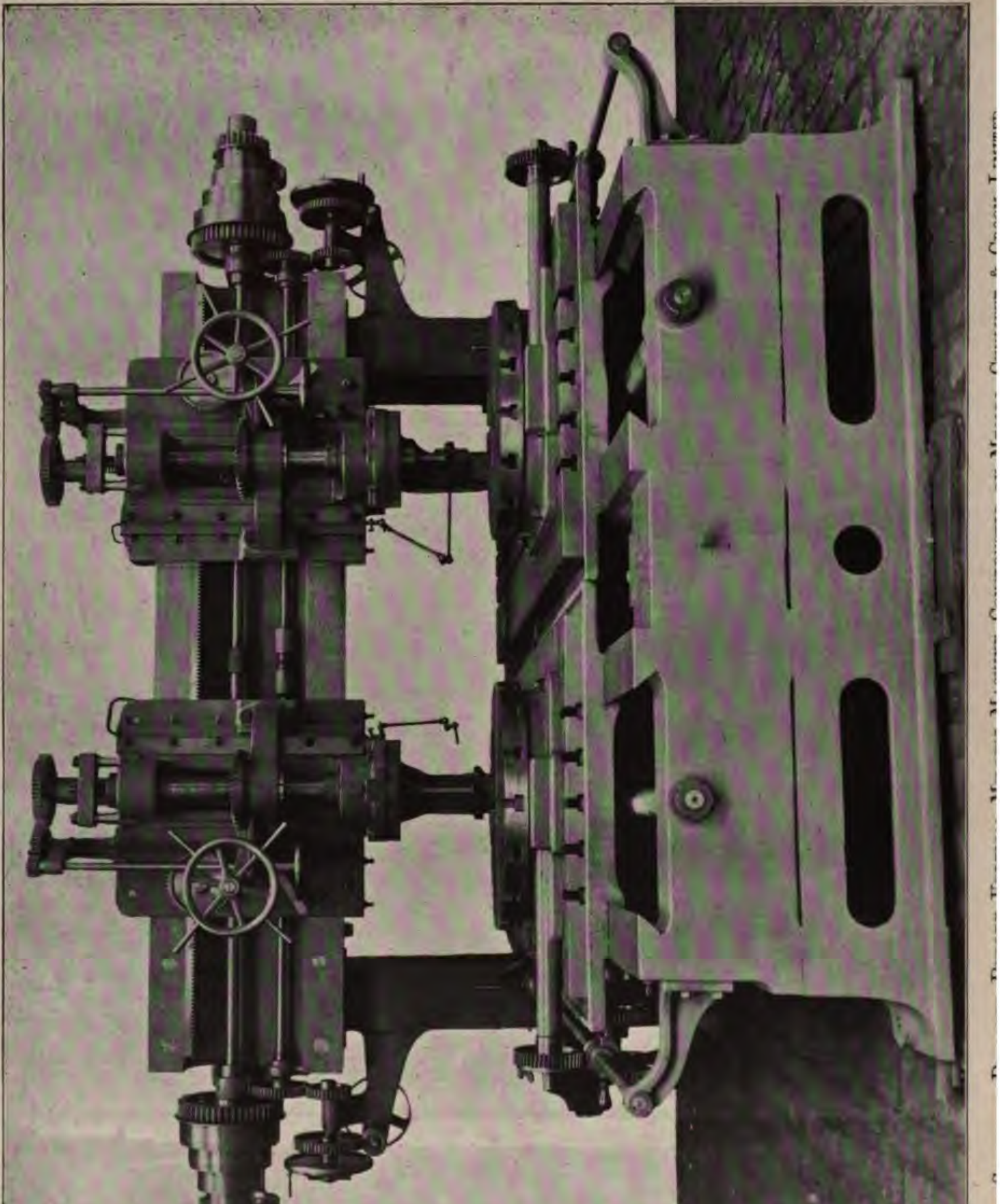
Shipbuilding.—During the month, a fair amount of tonnage has been launched on the Tyne, and the weather having been favourable for outdoor work, contracts at all the yards have been well advanced. The reconstructed s.s. *Milwaukee* has been successfully floated, and will shortly be ready to proceed to sea again, and it is to be hoped she will be more fortunate on her second maiden voyage than on her first. It is needless to repeat the history of this vessel, which has been amply dealt with in previous numbers; but at this juncture it will not be out of place to say that the salvage and reconstruction of the vessel constitute two of the most remarkable achievements that have ever been recorded in connection with the industry of shipbuilding.

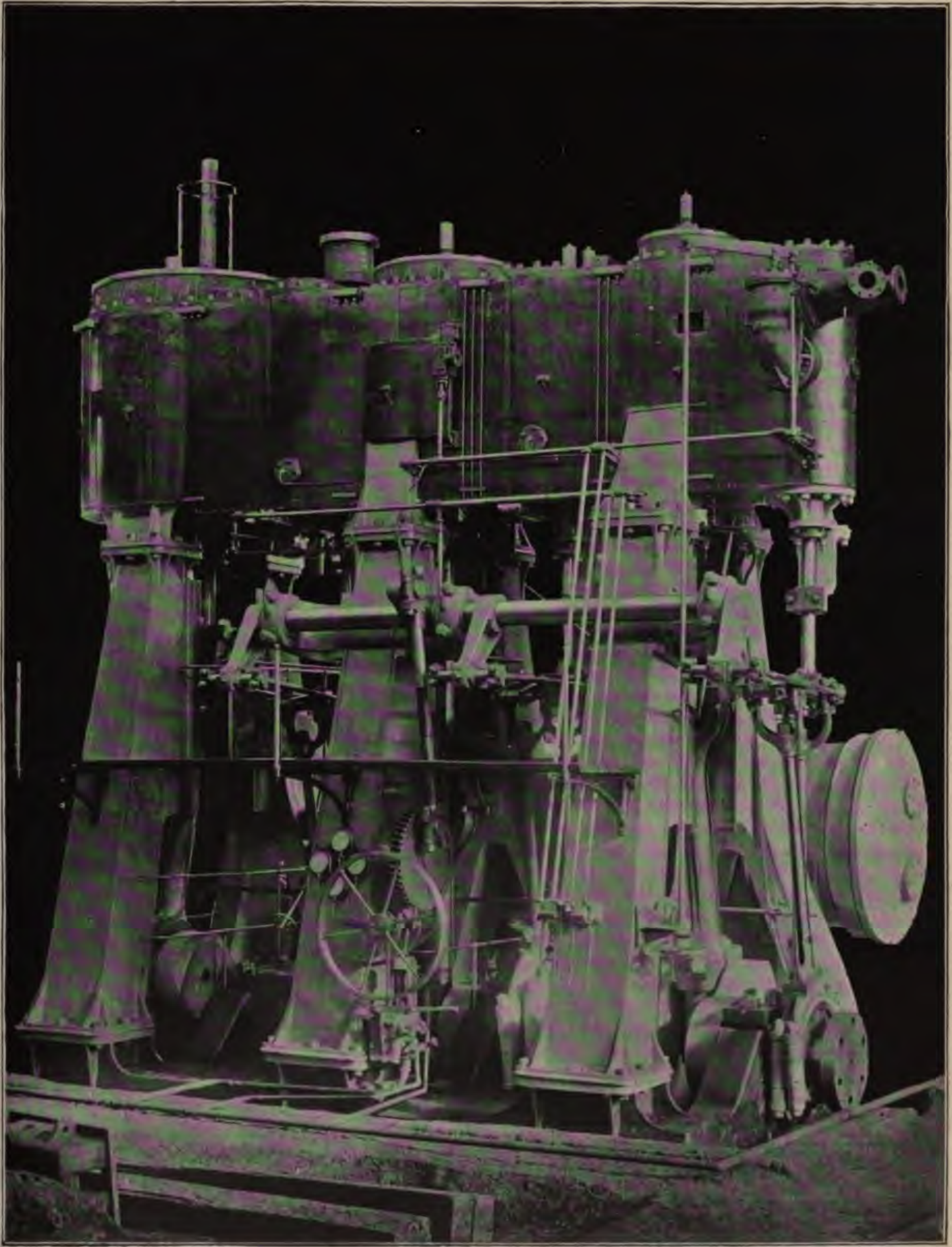
Only one order of importance has been heard of as having been booked lately, and that is a vessel of the very largest dimensions, placed with Messrs. C. S. Swan & Hunter by Messrs. Elder, Dempster & Co. This vessel is to have six large boilers, which, with the machinery, are to be constructed on the Tyne. It is understood to be a high-class cargo boat; but there will probably be accommodation provided for a limited number of passengers, and the vessel will be fitted with every modern appliance calculated to promote comfort and efficiency. The pontoon yard belonging to this enterprising Wallsend firm is still unoccupied; but rumours are afloat respecting negotiations for an exceptionally important contract, and it is confidently expected that long before the advent of winter the yard will be in full swing again.

Messrs. Armstrong, Whitworth & Co. have, as we anticipated, obtained from the Tyne Commissioners the permission asked for to strengthen by pile-driving the foundation of the river foreshore adjoining their Low Walker yard, with a view to the lengthening of their building berths. The steadily growing tendency to increase the size of vessels, which is everywhere noticeable among shipping people, has made a lengthening of the berths imperative in this, as well as in other cases, and as the company had already gone as far as was possible with their extensions in the opposite direction, all that remained for them was to complete the work by reclaiming a portion of the foreshore. The company have at present a large amount of mercantile work in hand, in addition to the warships—among the former class of contracts being a large vessel for the West India and Pacific Steam Navigation Co., and several large boats of Swan's patented design for the carrying of petroleum in bulk.

Messrs. Wigham, Richardson & Co.'s yard continues very active, and at Messrs. Hawthorn, Leslie & Co.'s yard, at the other side of the river, the berths are fully occupied with torpedo-destroyers, cattle ships, &c.; whilst in the graving dock, and in the river beside the yard, vessels are being fitted out or repaired.

The Palmer Co., having at the end of April launched the fine vessel *Manchester Port*, lost no time in placing another keel in the vacated berth, and the framing work of the vessel is now well advanced. The quite natural disappointment which was felt throughout the locality in reference to the





Triple-Expansion Engines of s.s. "Manchester Corporation," Built by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, Middlesbrough.

failure of the company to secure a larger portion of Government work than recently fell to their share has by this time given place to a feeling of thankfulness that there is an abundance of mercantile work in hand, and that full activity is assured in the yard for at least another seven or eight months. The Howdon yard belonging to the company is still, unfortunately, idle, and there seems to be no likelihood of the machinery being set going this year.

The Tyne Shipbuilding Co. have as much work in hand as they can conveniently deal with, and at the Northumberland yard there are four vessels on the stocks, and other orders to follow. The proprietors have launched their second vessel (which is now about ready for sea), and one of those on the stocks is well advanced towards completion.

The launching of two vessels in a year is not a very remarkable result, but it must be recollected that some time was occupied with preliminary work before the actual work of production got properly under way, and the inadequacy of the labour supply, especially in the plating and riveting departments, was felt from the first. In this, the second year of the company's existence, no doubt a different state of things will be witnessed; and, as the yard is both well equipped and well managed, it is reasonable to expect that the successes of the future will be sufficient to repay everyone connected with the forming of the company and the opening of the yard, for their labour and enterprise.

It is reported that Messrs. Readhead have recently added to their prospective work engagements an order for two steamers of a large and superior class. The information is, however, not authentic, and we can only give the statement for what it is worth. As Messrs. Readhead have never been known to be short of work during the past half score of years; and, as they launch a vessel almost every month, it seems clear that no very long interval can elapse without new orders being booked by them, and there is consequently some reason to suppose that the rumour referred to is correct. At the repairing establishments business continues fairly active, considering that at this period of the year repair work is usually scarce.

Engineering.—The Wallsend Slipway and Engineering Co., Limited, have, we understand, received the order to supply the engines and boilers (six in number) for the big vessel ordered by Messrs. Elder, Dempster & Co., from Messrs. Swan & Hunter, and it is understood that they have also booked further important orders for ice-breaker machinery. The remarkable success of the great ice-breaking vessel *Ermack*, built by Messrs. Armstrong, Whitworth & Co., and engined by the Wallsend Slipway Co., has given rise to the expectation that many more such vessels would be ordered on the Tyne; and it is satisfactory to be able to state that an order for a small one has been placed lately, and that negotiations for even a larger one than the *Ermack* are understood to be now in progress. The Slipway Co. have recently fitted the oil steamer *Cowrie*, owned by the Samuel Syndicate, with eleven burners (Rusden & Eeles's patent) for the consumption of liquid fuel, and this, we believe, is the sixth or seventh vessel that has been so fitted. An oil, which is said to be specially suitable for these burners, and which, being a residuum, is economically applicable, has been obtained from Borneo, where the supply, it is said is unlimited. The only difficulty apparently in the way of this oil being largely used is that of eliminating the admixture of water; but there is no reason to doubt that this difficulty will eventually be overcome, and the employment of liquid fuel in preference to coal, in oil steamers, may consequently be looked forward to with tolerable certainty.

A disastrous fire at the Elswick works has resulted in several hundred hands being temporarily thrown out of employment, the shops in which they worked having been destroyed, with all the machinery. As many as possible were put to work in other departments within a day or two of the occurrence; but it is feared that a considerable number will have to postpone their return to employment till the new shops, which are already in course of erection, are completed.

Both the engineering and the electrical works of Messrs. Clark, Chapman & Co., Gateshead, are very busy, and at the establishment of Messrs. Chapman & Furneaux (Black & Hawthorn's successors) considerable activity exists. The demand for Messrs. Carrick & Wardale's well known pumps for steamships is not only maintained, but is steadily developing, with the result that a further accession of activity is noticeable in the works. At Messrs. Abbots's, an extension of the boiler shop is being carried out, with a view to increase the productive capacity of that department, and in the arrangements of the iron foundries improvements are also being effected.

Messrs. Noble & Lund, of the machine tool works, Felling, continue to experience a good demand for their specialities, amongst which their special band saws, now so largely used in engineering works for cutting through cold iron or steel substances, should perhaps, have prominence. In the department where Mudd's patent piston rings are manufactured considerable briskness is to be noticed, and in the foundry departments activity also prevails.

Messrs. Robert Stephenson & Co., South Street, Newcastle, are well supplied with orders for marine and locomotive engines, and are exceptionally busy with the manufacture of a patent oil-engine, of which they have made a speciality.

The works of Messrs. Ernest Scott & Mountain—both electrical and engineering—show fully sustained activity, the orders for ship's pumps (Admiralty pattern) being numerous, whilst there is also a good amount of ship electric lighting in hand. Steelworks at Jarrow and Elswick are busy, whilst the small iron-rolling mills that still exist on the upper reaches of the Tyne are kept in steady operation. Forges, generally, are brisk, and there are few iron or brass foundries in the district that are not as full of work as could be desired.

Mr. W. F. Snowdon, of No. 2 Side, has had a great many contracts in hand this month for the covering of steamers' boilers. The demand for Snowdon's patent removable mattresses (for boiler covering) is steadily on the increase.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—In addition to the prospective opening out of shipbuilding and repairing works by Messrs. Short Brothers, at Seaham Harbour, we are now enabled to state that it is the intention of that firm shortly to utilise for shipbuilding purposes the yard to the east of their present establishment, which was acquired by them two or three years ago, but has, as yet, only been used for storage and fitting-out purposes. The opening out of this latter yard for shipbuilding is, we believe, contingent on the realisation of a scheme which has just been entered on, namely, the amalgamation of the iron (or steel) shipwrights with the wood shipwrights. The connection of this question with the prospective opening of the yard is that the alliance mentioned would ensure to Messrs. Short Brothers an adequate supply of capable workmen under any circumstances that might arise. It should be explained that Messrs. Short Brothers have always held themselves free from the domination of the Boilermakers' Society, which organisation rules paramount in practically all the other shipbuilding yards of the kingdom, and have depended exclusively upon the Shipwright Ironworkers, whose numbers are limited. The alliance of the two sections of shipwrights is all that is wanted to make the supply of workmen in the iron departments equal to all requirements, for it is well known, that the wood shipwrights (especially the younger men) can turn to the iron work with great facility. It may be mentioned here that a number of riveters left Messrs. Short Brothers a couple of weeks ago for the purpose of joining the Boilermakers Society. The general secretary of the latter organisation has since described the action of Mr. Short in paying off those men, as "high-handed." The real facts were that the men referred to were trying to induce the other workers to make common cause with themselves, with a view to force upon Messrs. Short Brothers acceptance of the Boilermakers' control or the alternative of having the yard laid idle. Mr. Short, as soon as he became aware of what was afloat, called the whole of the men together, and informed them that his firm would recognise only the Shipwright Ironworkers' Society in their yard, and that any men wishing to join the Boilermakers' Society (which would not be recognised) were at liberty to leave at once, and would be paid what was due to them before leaving. Since the departure of these men from the yard, their places have been filled by perfectly competent workmen, and the work has not been in the least degree impeded.

Messrs. W. Doxford & Sons continue very busy, and are now preparing to put down the big P. & O. boat ordered last year. At Sir James Laing's yard the state of work continues active, there being six vessels on the stocks. The extensive repair contract which has been in hand some weeks is nearly completed. The scheme of extension which has been entered upon at Messrs. Pickersgill's yard is of much greater scope than was originally supposed. The scheme involves the complete demolition of the existing machinery sheds, and the removal of the machines to a new shed which is being erected at right angles with the river. This will permit of the laying out of five berths, all running almost parallel with the stream, and capable of accomodating vessels of the largest class. The direction of the berths will give a launching way equal to that of any building berths in the yards at Sunderland or elsewhere. A quantity of new machinery is to be put down, and the general equipment of the yard will be brought thoroughly up to date.

In reference to the yards below bridge, little is to be recorded this month, excepting that all of them are still as busy as could be wished. At the yard of the Strand Shipbuilding Co., some trouble has been caused by the efforts of the Boilermakers' officials to induce the men (who like Short Brothers' men are Shipwright Ironworkers) to forfeit their allegiance to their employer, and to their own local union. They did not succeed, however, and it is scarcely likely that they will make any further attempts, considering the futility of their efforts on this occasion.

Both the large graving docks owned by the Wear Commissioners are occupied with vessels undergoing repair, and there is a good deal of repair work in hand at Messrs. Austin's and Messrs. J. L. Thompson's. In the ships' boat building trade only a moderate business is doing.

Engineering.—A new local company, named the Rectory Engineering Co., Limited, has been formed by a number of Sunderland gentlemen, to take over the old Rectory Engine Works, formerly (and until very recently) occupied by Messrs. J. G. Allison & Sons, in the manufacture of gas engines. A large number of the special type of engines made have been sold in the district as well as further afield, and their reputation for sound workmanship and economy in operation is excellent. It is the intention of the new company to continue the manufacture of gas engines, and also the business (previously carried on) of general repair work to gas and steam engines, millwrighting, &c. A portion of the works has been set apart and specially equipped for the manufacture of the Wilcox patent Radio-Mundal evaporators, feed-heaters, &c, for which there is a large and increasing demand. It needs only to be added that this new enterprise is being started under very favourable auspices, the company having some good orders already in progress, and expecting to have the works in full swing in the course of a few days. Mr. Percy Willcox has been appointed managing director, and Mr. Reginald Willcox, works manager.

We understand that Messrs. J. G. Moore, of the Vulcan Works, Church Street, Monkwearmouth, have leased an extensive piece of ground near the Strand Ferry, on which it is intended to build premises, better suited to their business than those they at present occupy. The firm also intend adding to their present business the manufacture of steering-gears, steam winches, &c., for the carrying out of which lines on an extensive scale the new premises (or rather a part of them) will be specially designed.

Messrs. MacColl & Pollock, of the Wreath Quay Engine Works, are fully supplied with orders to at least the end of the year, and still find it necessary, like all the big establishments, to keep a night shift going. New offices are being added to the works and will doubtless prove a great convenience.

Local ironworks are still very busily employed, and in the foundries full activity exists. At the Sunderland Forge business is as brisk as ever in both the electrical and engineering departments. Brass and copper works are busy, and in the manufacture of special types of anchors there is still a good deal doing.

The Hartlepools.—Shipbuilding is still active at the Hartlepool and West Hartlepool yards, and during the fine weather now prevailing, overtime is being largely worked by the outside hands. In the repairing departments work is active, there being some good contracts in hand. The engineering trade also continues brisk, and night-shift is maintained in the factories. Forges and foundries are kept going briskly, and timber importations having largely increased lately, a good demand for labour now exists at the docks.

Stockton.—Here also shipbuilding continues brisk, Messrs. *Ropner's being, perhaps, the busiest* yard in the district. In the *engineering works no signs of coming slackness* are as yet visible, and both bridge works and boiler works show as much activity as at any former period.

Middlesbrough.—All the berths in the yards at this centre are occupied with vessels building, and there is also a considerable amount of repair work in hand. Steelworks are still pressed with orders, and prices remain firm. At the docks business continues to improve, owing to the larger arrivals of timber-laden vessels.

Consett.—The pressure of work at the Consett Co.'s iron and steel-rolling mills is as great as ever, and everything possible is being done to further increase the output, which is now much larger than at any former time.

THE MERSEY.

(*From our own Correspondent.*)

ALTHOUGH the work in hand throughout this district, both in connection with shipbuilding and marine and general engineering, is more than sufficient to keep establishments fully engaged, and will in most cases carry them well into next year, there is unquestionably a slackening-off as regards new inquiries coming forward; and the question arises, in many quarters, whether the large and serious upward move in the price of all descriptions of material which has been going on during the past month may not tend to check the placing out of new orders. Certainly shipbuilding and engineering firms, in quoting for new work, will have to very considerably increase their prices in order to enable them to cover the very greatly enhanced cost of production; and whether trade is in a sufficiently "booming" condition to stand this rapid upward move in prices—which do not as yet seem to have touched the top—is a matter which only further developments during the ensuing six months can determine with any definiteness.

The returns issued by the leading trade unions still show a very low unemployed list. The Amalgamated Society of Engineers has only 2⅓ per cent. of its total membership on out-of-work donation, whilst in this immediate district the proportion is just under 3 per cent. In the Steam Engine Makers' Society there is about 1 per cent. of the total membership on benefit, but, locally, practically a "clear book" is reported. The United Machine Workers' Association has a trifle under 2 per cent. of its total membership on donation, with about 1⅓ per cent. receiving support in the Lancashire district. Reports as to the state of trade continue very satisfactory. In the Amalgamated Society of Engineers only 15 out of over 520 branches in the United Kingdom report trade as "bad," and in the other societies the proportion is even less. With regard to labour matters, an adjourned conference is to take place at an early date with reference to the wages question in mid-Lancashire. At Liverpool a demand from the men for a general advance has been met with a point-blank refusal, coupled, however, with a hint that if the workmen are not satisfied, they can appeal to the central authority.

Messrs. Holden & Brooke, Limited, West Gorton, Manchester have brought out a new form of exhaust steam-injector (Brooke's patent), specially designed for feeding against high pressures, such as 180 to 200 lbs. This apparatus is a combination of two injectors—one, the larger, worked by exhaust, and the other by live steam. The exhaust portion is operated in the usual way by a branch direct from the exhaust pipe, and the highly heated water thus obtained is forced direct into the second, or "supplementary," injector, whence, by the aid of a small jet of live steam, it is forced into the boiler. Live steam is turned on immediately the exhaust-injector has been started (which in the meantime discharges through an overflow cock on the side of the supplementary injector) by raising a lever, which simultaneously closes the overflow, by which time the injector is delivering into the boiler. It is claimed that by this arrangement, whilst the economy due to the use of exhaust steam remains unaltered, there is a further economy arising from the use of the live steam jet, owing to the fact that every increase in the temperature of the feed water, even if obtained solely by live steam, has marked advantages over feed of a lower temperature, both as regards steaming capacity and the life of the boiler. The temperature at which the injector delivers its feed ranges from 235 to 270 degrees Fahr. The apparatus has been severely tested at important locomotive and engineering works, against 200 lbs. pressure, with very satisfactory results.

A new apparatus (Baker's patent) for softening and purifying water for steam-raising and other requirements has been introduced by Messrs. D. Bridge & Co., Salford, Manchester. In this arrangement the water is blown into the upper part of the apparatus in spray, and there met by steam in such proportion that the water boils, and at this stage a small quantity of calcide solution is introduced. The heated water and calcide pass down several concave and conical surfaces in the heater, becoming thoroughly mixed, and the lime with other impurities at once separates from the liquid in heavy insoluble particles, the greater part of which at once falls to the bottom of the first of three compartments of a depositing tank; the clear softened water from the top of the first compartment then passes to the bottom of the second, and from that to the third, whence it finally passes out through a suction pipe to the boiler feed pump, or elsewhere as required.

Messrs. J. Stott & Co., of the Vernon Works, Oldham, have a number of new designs in ventilating, lighting, and heating appliances. Amongst these is the "Stott" water-fan, which is specially serviceable for ventilating purposes where water is available and more convenient to apply than any other power. The water is admitted through a pipe at the top of the fan, and is applied through a modified form of the Pelton wheel, which is introduced in the ring of the fan, and connected with the revolving blades. Another new apparatus is a patent acetylene-gas generator, which is an automatic arrangement on the duplicate system, whereby one chamber can be cleared and renewed whilst the other is at work, without stopping the supply of gas. The apparatus is also fitted with patent cooling pipes, the effect of which is that the gas feeds into the holders at the same temperature as that of the outside air. The firm have also brought out an improved form of the Ballantine-Stott patent water-heater, in which the steam and the water valves are both operated at the same time, and the temperature of the heated water is regulated to a maximum of 110 degs., so that there is no danger of the user becoming scalded.

On June 3rd the members of the Manchester Association of Engineers paid a visit to the works of Messrs. Joseph Adamson & Co., at Hyde. These works are specially interesting as affording a good illustration of the most modern equipment for electric-power driving, the majority of the machines in the establishment being driven in this manner, whilst there are further interesting features in connection with the arrangements that have been made for saving labour in the handling of materials. Amongst the work in progress attention was paid to two steel-plate fly-wheels, 24 ft. diameter, each weighing 45 tons, which were being built for Messrs. Cole, Marchant & Morley; also a 50-ton travelling crane 62 ft. span for Messrs. C. Cammell & Co., Limited, Sheffield; and in contrast with this a smaller crane to deal with loads of five tons, on a span of 40 ft., for the Earl of Dudley's Round Oak Works Co., Limited, Brierley Hill, Staffordshire. Before leaving the works, the president of the association, Mr. Henry Webb, moved a vote of thanks to the firm for their kindness in allowing the members to visit the establishment, and Mr. Joseph Adamson, in responding, remarked that they could not expect workmen to produce the best work except in a clean, bright, and well-organised shop.

The upward move in prices in the iron trade here, which has been reported for some months past, still goes on without any check either as regards raw or manufactured material. The business doing is of no great weight, but it is more than makers and manufacturers can entertain. In pig-iron, prices have advanced 6s. to 9s. per ton during the month. For local and district brands makers have generally little or nothing to offer, and for the most part are declining to quote at all, except for small quantities to keep their regular customers going. The prices now asked average about 67s. 6d., less 2½ for Lancashire, 65s. 6d. net for Lincolnshire, and about 67s. for Derbyshire foundry, delivered Manchester; with forge qualities delivered Warrington, not quoted under 65s. to 65s. 6d., less 2½ for Lancashire, and 64s. 2d. net cash for Lincolnshire. Middlesbrough foundry has shown an upward move of fully 9s. per ton, and good foundry qualities are now quoted 73s. 7d. net, delivered Manchester, with orders exceedingly difficult to place; whilst Scotch iron is about 4s. higher, makers asking 72s. for Eglinton and Glengarnock, delivered Manchester Docks. For American pig-iron about 64s. net at docks has been quoted, but at the time of writing no prices are obtainable.

In the finished-iron trade there has been a further official advance in list rates, bars and hoops having been put up 10s., and merchants' stock prices have also been raised 10s. per ton. This upward move has apparently put no appreciable check upon business. Delivered Manchester district, Lancashire bars are now quoted £7 15s., and North Staffordshire £8, with hoops £8 2s. 6d. for random to £8 7s. 6d. for special cut lengths, delivered Manchester district, with 2s. 6d. less for shipment. Sheets have also hardened up about 5s. per ton, £8 12s. 6d. to £8 15s. being now quoted for delivery here.

Prices in the steel trade have shown some irregularity, raw material having advanced 7s. to 10s. per ton, whilst in manufactured material the upward move has been chiefly confined to special brands. Hematites are now 79s, with special brands 82s. to 82s. 6d., less 2½, and local billets £5 17s. 6d. net. Local steel bars are £7 15s., with some special brands, £8, whilst boiler plates range from £8 15s. to £9; hoops have been officially raised 15s. per ton, £8 10s. being now the basis for delivery in this district.

There is no material change to note as regards the metal market, manufacturers being pressed with orders, and prices firm at late list rates. Delivered Manchester district, solid-drawn brass boiler-tubes are quoted 9d.; solid-drawn brass surface-condenser tubes 10½d.; solid-drawn copper tubes 11¼d; brazed copper gas and steam tubes 11¼d; brazed brass tubes 10d.; common rolled brass 8¾d; common brass wire 8½d; copper wire 10¼d. per lb.

Business in the timber trade has been fairly satisfactory The new season's imports are now coming forward and meet with a tolerably good enquiry; stocks generally are not excessive and prices, except for a few articles, are firm. Teak squares have arrived more freely and have been chiefly stored for shippers' account; there is a fair demand, and prices are steady, with stocks moderate. Planks continue in good demand, with values maintained, and stocks are not excessive. One cargo of greenheart has arrived from Demerara, and a parcel of large average logs transhipped from Middelburg, which has gone direct into consumption; the demand has been moderate, but stocks are too heavy.

In the coal trade there has necessarily been a considerable falling off in requirements for house fire consumption, but pits have generally been kept on full time, and any surplus output of the better qualities of round coal is required to go into stock to meet the ensuing winter demand. Prices for house coals are firm at late rates, and contracts with merchants are only being accepted at present full prices, subject to any further advance that may take place during the period of delivery. Steam and forge coals are in active request, with prices hardening on late quotations. Engine fuel is in brisk demand, and the better sorts continue scarce, and very firm in price, but the lower descriptions are somewhat more plentiful, and not quite so strong at late full rates. At the pit's-mouth best Wigan Arley averages 12s. to 12s. 6d.; Pemberton 4 ft. and seconds Arley, 10s. 6d. to 11s.; common house coal, 9s. 6d. to 10s.; steam and forge coal, 9s. to 9s. 6d.; engine fuel, from 4s. 9d. to 5s. 3d. for common, 5s. 6d. to 6s. for medium, and 6s. 6d. to 6s. 9d. for best sorts. Coke is becoming increasingly scarce, and prices show a continued upward move, ordinary furnace qualities fetching 18s. to 19s., and good foundry qualities from 24s. to 26s at the ovens.

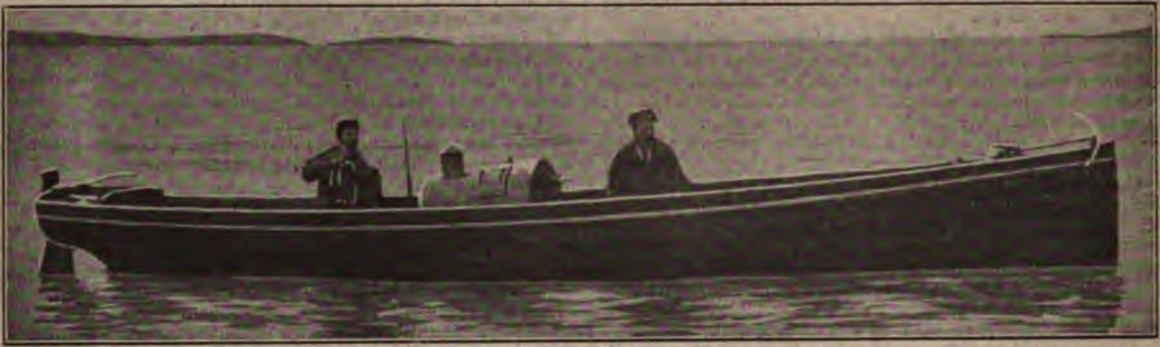
There is a fairly active shipping business, but prices are without quotable change, ordinary steam coals, delivered Garston Docks, fetching about 9s. 6d. to 9s. 9d.; delivered high level, Liverpool, 10s.; and Ship Canal, 10s. 6d. per ton.

THAMES.

(*From our own Correspondent.*)

THE *Marine Engineering*, of New York, gives first place to an article on the *Farragut*, the first American torpedo-boat destroyer, which has just been completed, and recently underwent her trials. She was built by the Union Ironworks, and launched on July 16th, 1898. Her dimensions are 214 ft. over all, beam 20 ft.; draught, 5 ft. 7 in.; and trial displacement, 240 tons. She is fitted with twin-screw engines of the four-cylinder four-crank triple-expansion type, with cylinders 20 in., 29 in., and two 30 in. diameter, and 18 in. stroke. The air pumps are drawn direct from the crank shafts. The boilers are three in number, and of the Thornycroft type, each rated at 2,000 H.P, with 240 lbs. pressure. These boilers of the *Farragut* were built in the United States under licence from Messrs. John I. Thornycroft. There will soon be tried the skill of this firm in racing yacht building. In our Electrical columns will be found a reference to M. Marconi preparing to fit his system of wireless telegraphy to record the international race. This country will be represented by the *Shamrock*, which is now undergoing her internal fittings. It will then be seen whether American or English builders are the better.

Messrs. Tolch & Co., of Fulham, have under construction two 35 ft. oil launches for the Government Coast Guard service. They have also built a harbour boat of whale-boat shape. The name of this boat is the *Muriel Dora*. She is 30 ft., 7 ft. 6 in. beam, and carries three tons. Her engines are double cylinder, 6 B. H.P. She is to be used for going round the light buoys in the harbour. They have also built a launch for the War Office Submarine Mine service (Fig. 1). Her dimensions are 67 ft., 15 ft. beam, and 8 ft. 3 in. depth. Her engines are double-cylinder, and 15 H.P., and she makes seven knots an hour. They are at present engaged with two for the Thames yachtsmen.



Teak Launch, Copper-Sheathed, with 5 B.H.P. Balanced Engines, War Office, Submarine Mining, Weymouth.
Fig. 1.

The Belleville Again.—Mr. William Allan has had a little Belleville boiler made to scale, of which the tubes are glass. This enables one to see the circulation of water, and whether the tubes are always full of water, or sometimes water and steam, or sometimes steam alone. Mr. Allan went further than that, for he took his model with the glass tubes to the smoking-room of the House of Commons, and there made it work before a number of interested members of Parliament Mr. Allan argues that the tubes are often mostly full of steam, and that this is due to defective circulation. A number of articles have been appearing in the *Pall Mall Gazette* on the same subject, only the writer in the evening paper is not so discriminating as Mr. Allan—he writes against all water-tube boilers. Mr. Milton and inspectors of the Board of Trade are quoted very indiscriminately, and there are other people brought in whose opinion is not of very great value. But the Admiralty will probably, and very wisely, go on its own way all the same. We have always had a preference for the express type of water-tube boilers, and it must be confessed that the working condition in the stoke-hold of a destroyer, even when she is running at her highest speed out is very excellent and comfortable. As far as we can see, these boilers are making way in the navies of other Governments. It will be seen above that the Thornycroft style of boiler has been fitted into the first destroyer constructed for the States.

Messrs. Yarrow & Co. are also fitting their type with modifications to suit the different conditions. Not less than six cruisers of 10,000 H.P. each have been fitted, or are about to be fitted, with these boilers. There are also two battleships of 6,000 H.P. each to be fitted with them. The ordinary Yarrow express type of boilers has tubes 1 in. diameter, whilst the modified boiler of this type has tubes 1¼ in. diameter, and they are stronger and thicker in every part. Then again, the heating surface is increased per I.H.P. In the express type 2 ft. are allowed per I.H.P.; in these larger boilers, suitable for battleships, the allowance is 2½ square feet of heating surface per I.H.P. The draught pressure also is reduced from 2½ in or 3 in. of water to from 1 in to 15 in. of water. The capacity of these water-tube boilers is greatly *increased. Four boilers* are used in the Japanese destroyer, *giving an aggregate steaming capacity of* 6,500 H.P. with 1½ in. air pressure in the stoke-hold. The total weight of the fire boilers with water is 72 tons, that is, 25 lbs. per I.H.P. Messrs. Yarrow are also fitting a Portuguese cruiser of 12,700 I.H.P. with 12 Yarrow boilers, and two Norwegian ironclads are also being fitted at Elswick with the same type.

The Pyrometers which have in the past been used by engineers for furnace temperature have not been very reliable. That which has been invented, constructed, and tried by Professor Callendar, of University College, London, appears to be a very sensitive and reliable instrument. It consists of a Wheatstone bridge, the slider is automatically effected by relays worked by the current passing through the galvanometer between the bridge arms. There is also a platinum thermometer to work with it. It consists, says *Engineering*, of a coil of platinum wire insulated by being wound on a frame of mica. The ends of this wire are soldered to two copper or platinum leads, which connect it to two of the four terminals with which the instrument is provided. The increase of the resistance of this platinum coil with rise of temperature is of course a measure of that temperature; and, should the thermometer form part of a Wheatstone bridge, the balance of the latter will be disturbed, and when the instrument is connected to the recorder, this balance is readjusted automatically. These thermometers can be made to indicate the one-thousandth of one deg. Cent. and determine temperature down to the freezing point of platinum. The resistance of the platinum coil is a parabolic function of its temperature, and the standardisation of the instrument is easy. At the conversazione of the Royal Society, held on May 3rd last, four of the recorders were on exhibition. One was fitted up as a sunshine recorder; a second as an automatic temperature regulator, maintaining a gas furnace at a constant temperature of 1,000 deg. Cent. within ½ deg. Cent. of absolute steadiness; a third was used as a thermo-electric pyrometer, measuring the temperature of a Bunsen flame; whilst the fourth acted as a recording watt-meter.

Caird & Rayner having been trying a new system of working with steam used in ships of war. Instead of exhausting the steam from the low-pressure cylinder into the condenser the pressure of steam is raised by steps throughout the system and exhausted finally into the evaporators. One of the ships so fitted is H.M.S. *Hermes*, and she was on trial off Plymouth on May 29th. At the conclusion of the trial the mean I.H.P. was found to have been 2,099. The boiler pressure was 203 lbs., which was reduced to 157 lbs. at the engines. With the above power, which was 99 I.H.P. above the one-fifth full power, she attained 13·4 knots. The exhaust produced all the feed water required. Sir John Durston is still making experiments on the effect of high-pressure steam in the jackets of the cylinders. When the above trials were finished, she was sent on a 12 hours' duration trial at 1,000 I.H.P. one-tenth full power. During the first four hours the jackets were used on all cylinders; in the second four hours they were only used in the low-pressure cylinders, and in the third four hours they were not used at all. In the 30 hours contract trial the same requirements were made, the 30 hours being divided into three periods of ten hours each.

Messrs. John Penn & Sons, one of the very oldest marine engineering firms in the country, is going to lose its name, as it is being taken over by the Thames Limited Co., across the water. The ships will still be built at the old place and the engines at what has been known for the last century as John Penn & Sons, Mr. Hills, of the Thames Limited, is the head of the joint firm, and application was made this week in court to allow the name to be changed. They have jointly begun well. The two battleships *Duncan* and *Cornwallis* will keep them busy for the next two or three years. The engines and boilers for the battleships are to be constructed at the new department of the firm. The engines are to be built on the system in vogue at the Admiralty at present—one high-pressure, an intermediate, and two low-pressure cylinders; they are twin engines for twin screws. The dimensions of the cylinders are to be 33½ in. high pressure, 54½ in. intermediate-pressure, and two 63 in. low-pressure, with 4 ft. stroke. They will probably exhaust into the evaporators. Each battleship is to be fitted with 24 Belleville boilers with economisers, the pressure in the boiler being 300 lbs., and this is reduced by the reducing valve to 250 lbs. A great amount of new machine tools and plant for the construction of the boilers is being laid down, and new shops are being laid out and built for the construction of these boilers at the old place at Greenwich and not at Deptford, where the Blechynden boilers and cylindrical boilers were built. The Blechynden boilers fitted into the third-class cruisers *Pactolus* and *Pomone* are giving every satisfaction, no complaints or burst tubes have been heard of. The *Pactolus* has been up the Mediterranean. Each of these third-class cruisers was designed to develop 7,000 I.H.P., and eight Blechynden boilers were fitted into each vessel for this purpose. The thickness of the tubes was 11·6 in. for the express type of Blechynden boiler and the thickness of the tubes for the Belleville is to be 192 in.

BELFAST.

(*From our own Correspondent.*)

WE have nothing during the month to report in the matter of launches. We have seldom if ever had so few launches in the early months of the year, and indeed unless there is a great deal more work done shortly, the finished tonnage will fall short of previous years, but, as mentioned in our last report, the main cause of this is the scarcity of ironworkers and material.

Both the large shipbuilding firms here are involved in the failure of the largest Glasgow iron merchants, and this has seriously handicapped them in delivery, and in having to re-order material at an enormous advance in price, causing unforeseen delays in the output of work, which we are afraid cannot be overtaken during the remaining months of the year, although there is certainly abundance of work on hand with the enormous amount of tonnage still surrounding the yard of Messrs. Harland & Wolff.

At the adjacent docks we have still the *Oceanic*, which occupies a large space in herself. She is fast advancing towards completion, and had a most satisfactory turn of her engines, one engine at a time being run, and that very slowly and cautiously, the ship being moored at a distance from the wharf.

The event of the month has been the docking of the P. & O. steamer *China*. As is well known, this vessel after being floated off the rocks at Perim at an enormous expense, came to Belfast about two months ago under her own steam, accompanied by two powerful tugs. Prior to docking her the boilers and funnels, the foremast, and all the top gear were removed, as little idea could be formed as to the extent of damage to her bottom. The plan was resolved on of hanging the upper part of the vessel by cutting large square holes in her sides below the structural framework of the upper decks; through these holes large heavy logs of timber were inserted athwartships, shored and braced to the beams internally, but the ends of the logs on each side projecting so far out as to enable a heavy log shore to be put upright from the bottom of the dock to the underside of crossbeams. This work required very careful measurement and study, as these shores had all to be placed in position, while the vessel was afloat in dry dock. Notwithstanding all these details, the docking operation only occupied six hours, which, after seeing the work that has been done, was really a feat in itself. On the dock being pumped dry, a great sight was presented to view, one part of the keel was set upright about eight feet from the straight line upwards, with the plates and frames in every conceivable shape of indents and twists which the rocks had made while she lay fast at Perim. Notwithstanding this very few of the plates were cracked, or the rivets started, but where they were broken they had been most ingeniously patched with wood and cement by the divers under water. Then again another difficulty had to be faced. With the enormous quantity of cement used to make the ship watertight, how was the mass to be removed? Finally it was decided to use dynamite, and with this the whole of the fractured part of the bottom has been blown off in pieces, and now, after the wreckage being cleared away, the work of reconstruction has begun, and no doubt she will be as good as a new ship when she is finished. But it is really an interesting and novel sight to see such a large ship hung up by her upper structure, and her bottom part cut clean away, with the new structure rising to meet the old.

The s.s. *Germanic*, of the White Star Line, has been in the hands of the builders, Messrs. Harland & Wolff, for some months, getting an extensive overhaul after the extraordinary accident which befell her last winter in New York Harbour. The mishap destroyed most of her internal fittings, so all the woodwork and decorations have been removed, and have been replaced by an entirely new design of saloon, library, and smoking-room, along with all the latest improvements of the company. She left Belfast on the third of the month for Liverpool, with a select company of owners and friends on board, and has since sailed for New York in her regular station.

The s.s. *Medic* and s.s. *Afric*, both of the White Star Line, lie in Abercorn Basin, with a large number of men on board each of them; and the s.s. *Belgic*, of the same line, has also arrived at the Alexandria Wharf, it is said, to receive overhaul and new boilers.

The s.s. *Winifredian* is still here in port, and has a good deal of work to be done before being completed.

The s.s. *Cambronian*, of the Dominion Line, is also here receiving alterations and overhaul, and the s.s. *Sandusky*, now named the *Englishman*, which has been purchased by the Dominion Line, is also here for requisite fitting similar to her sister ship, and suitable for the Atlantic trade.

The s.s. *Gaekwar*, belonging to the Brocklebank Line, which arrived at this port over a week ago, after being ashore at Tiree on the Scotch coast, has had to leave this port and proceed to Liverpool, on account of want of accommodation of dry dock, the Alexandria Dock being occupied by the *China*, and the Hamilton Dock by a large sailing ship. Surely this should open the eyes of those concerned in this matter.

Trade with the smaller engineers and ironfounders throughout the town still keeps good, but there is undoubtedly a falling off in inquiries for new work all round. Let us hope this may only be temporary.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—The shipbuilding trade of Barrow is very brisk in every department, and builders remain exceedingly busy all round. There is not, however, a very good demand for new commercial tonnage, possibly because the recent orders placed represent a very large tonnage of new shipping, and secondly because the cost of building, with increased cost of raw material and increased wages, is almost prohibitive. At the same time some of the best lines are in the market, and it is probable before long they will place good orders in various yards throughout the country for the highest class of vessels. On the other hand, it is evident that in these days of brisk shipping business owners of tonnage will increase the number of ships engaged in the general cargo trades. The tendency in this regard is to build ships of very large tonnage for the ocean trade; and, whilst it is not probable that the common tramp class of steamers will ever be built at the Barrow yard, it is possible some of the biggest cargo boats may be built here, because the yard is one capable of building the very largest ships ever launched or yet to be launched, and the docks at Barrow have wide enough entrances and deep enough water to float either the biggest commercial steamer or the heaviest mounted line of battleship. In the meantime, with the exception of the Pacific Steam Navigation Co.'s steamer *Ortona* now building, and a trifling job for one of the Clan Line steamers, there are no commercial orders in the hands of Messrs. Vickers, Sons & Maxim. They are setting the Naval Construction Works out especially for the production of Admiralty ships, and they are likely to do a very big business in this department, but they would not refuse good orders for high-class commercial ships, indeed they are ready to accept orders for the best type of tonnage any day. The launch of the s.s. Bornu, for the West African Steamship Co., enabled

Messrs. Vickers to put down the keel of the first-class protected cruiser *Euryalus*, and when the *Ortona* is launched on the 10th of this month (July), her place will be taken by the new first-class protected cruiser *King Alfred*, one of the improved *Powerfuls*. When H.M.S. *Vengeance* is launched on the 25th of July her ways will be ready for any new order for a big ship that may turn up, and the fact that the *King Alfred* is not going down on these ways is proof that some other big order is in the air. It is anticipated that Barrow will play a more active part in the future in building for foreign navies than in the past. At present the only ship under construction for a foreign navy at Barrow is a Japan line of battleship of 15,000 tons, but the works have not been under the control of Messrs. Vickers long enough a time to enable them to carry out the full scheme of extensions which they contemplate, and which will be necessary to enable them to tackle the fuller programme of industrial operations that their large naval shipbuilding scheme embraces. This is a difficulty which time alone can get over, and in the meantime every effort is being made to complete extensions to premises, lay down new and modern machinery, build new departments, and extend the yard area so as to make the concern at any rate double the size it was when taken over from the Naval Construction & Armaments Co. In addition to the new departments already determined on in the yard, a new iron foundry, steel foundry, brass foundry, and copper shop are being added to the premises. There is still a great scarcity of houses for workmen, and, although a scheme is on foot for providing 1,000 to 1,200 houses on Walney Island, it is evident some special accommodation will be needed in the meantime to house the large number of men who are required to push forward the orders in hand at the Barrow works. The West African Steamship Co.'s *Bornu* had her trial trip from Barrow to Liverpool, in the first week of June, and it was in every respect highly successful. It is understood the company is anxious to place out orders for further additions to their fleet, but Barrow builders are too busy at present to undertake any other work than that which is in hand and that which is in perspective. During the month the carpenters struck work at the Barrow yard because the joiners were put on to do some insulating casing on one of the Admiralty ships in course of construction, The carpenters claimed this as their job, and the joiners persisted in doing the work. After the carpenters had been on strike a few days, however, they decided to submit the dispute to arbitration, and to go on with their work meanwhile, the joiners in the meantime to proceed with the casing about which the dispute arose. There is a growing disposition at Barrow to settle all disputes by means of arbitration, The usefulness of gantries over shipways when vessels are in course of construction has been so thoroughly demonstrated that it has been decided at the Barrow yard to adopt this principle at the permanent shipways. There is no doubt great economy in this practice, and it doubtless affords means for the more expeditious building of ships. The Furness Railway Co.'s Bill to obtain powers to build a new graving dock and lock at Barrow, and for other purposes, has practically passed through its Parliamentary stages. In the first place, however, the Company will not proceed to build this dock, but will commence operations for the lowering of the cill of the lock entering the Ramsden dock by 6 ft. This will enable big warships and other vessels of 30 ft. draught and 80 ft. broad to get in and out of the docks at Barrow. This is necessary, because the vessels have to go through the docks to the big hydraulic crane alongside the engine shops and boiler shops where they take in their engines and general fittings, and the larger tonnage of vessels now being constructed at Barrow necessitates this extra depth of water. The 100-ton hydraulic crane has now been fixed up to lift 120 tons, and some of the marine boilers now built approximate to this figure.

West Cumberland.—The shipbuilding business in West Cumberland is very busily employed, and the two yards at Workington and at Maryport are well off for orders. At Messrs. R. Williamson & Son's shipyard, Workington, on May 30th a new steamship, the *Formby*, was launched for Messrs. J. Edwards & Co., Liverpool. She is 152 ft. long, 26 ft. 6 in. beam, and depth, moulded, 12 ft. 3 in. She is designed to carry 520 tons. She will be engined by Messrs. Ross & Duncan, Govan. It is in the building of this small class of steamer, that West Cumberland shipbuilders find their trade, and orders for various types of light draught vessels are in hand as well at Workington as at Maryport. Some day, it is hoped, engineering works will be established in West Cumberland to supply locally built steamers with engines and boilers complete.

Shipbuilding Material.—There is a very full and steady demand for steel shipbuilding material in this district, and makers are very fully employed in the production of heavy and light steel plates, angles, sections, and other incidentals required in ship construction. Some apprehension was felt a short time ago that the falling-off in the demand for mercantile marine tonnage would lead to a lessened demand for shipbuilding material all round, and especially so after Christmas of the present year. Up to that time orders are very largely held as well for Admiralty work as for the mercantile marine. It is evident there will be a continued demand on Admiralty account after this year, because orders are held by builders which will keep their yards fully employed for two years to come, and in the meantime makers continue to book occasional orders for commercial work. It is probable this trade will grow, because there is no foreign competition fit to speak of in the shipbuilding material trade whereby British makers may expect to lose any of their present business, and on the other hand there is every indication that our foreign trade may profit by the general briskness of things abroad. Makers quote £7 6s. 3d. for plates of ordinary specification, and £6 18s. 6d. for angles. Very few angles are being made in this district, but it is probable a new mill will soon be put down. The steel foundries are very busy. Their capacity of output has recently been increased, and will likely have to be still further augmented, as the trade doing is so very great and is likely to remain so.

The Hematite Trade.—There is a very brisk tone in the hematite pig-iron trade, and business is very fully maintained; indeed, makers could readily sell the product of six more furnaces if they could possibly keep more than 42 in blast on the supplies of raw material at command. The product of these furnaces represents a million and a half tons of iron per year. Prices are very firm, and show a distinct advance on the month. Makers quote 72s. to 73s. per ton net f.o.b. for mixed Bessemer numbers, and warrant sellers are at 72s. 2½d. net cash; buyers, 71s. 8d. Stocks have slightly increased, and now stand at 232,057 tons, or 56,078 tons increase since Christmas of last year. The prospects of the iron trade are very good all round.

Shipping.—The shipping trade is fairly busy at West Coast ports, being chiefly employed in imports of Spanish ore and American and other timber and in the export of pig-iron and steel. The returns so far this year show a marked improvement in imports, the figures making up a record tonnage. Of pig-iron this year so far 236,295 tons have been exported as well as 229,269 tons of steel. In the corresponding period of last year 235,589 tons of pig-iron and 262,773 tons of steel were exported, showing an increase this year of 706 tons of pig-iron and a decrease of 33,504 tons of steel. Freights are very satisfactory, and there is a good demand for shipping tonnage generally, foreign as well as coastwise.

SOME INTERESTING DIAGRAMS FROM TRIPLE-EXPANSION ENGINES.

WE have received from one of our correspondents in the East some extremely interesting diagrams relative to a set of triple-expansion engines of a steamer running in the Eastern waters. The engines have cylinders 19 in., 33 in., and 54 in. diameter by 33 in. stroke, and the pressure of steam is 100 lbs. per square inch. It was found that the engines were not working as satisfactory as might be expected, and in consequence the theoretical diagrams, as shown in Fig. 1, were set out. From these diagrams the necessary particulars were obtained to reconstruct and reset the valves. In Fig. 2 we show the actual diagrams after the alteration.

In the theoretical diagrams it was estimated that at 94 revolutions per minute the I.H.P. would be about 1,250. The actual diagrams show, although with adverse wind and tide, and at 95 revolutions per minute, a total H.P. of 1,091 was obtained. The pressure in the mid-pressure receiver was 66 lbs., and in the low-pressure 12½ lbs. per square inch. The high-pressure engine gave 280 H.P., the mid-pressure 406, and the low-pressure 405.

In the matter of coal, which was of inferior quality, it was found that the consumption was at the rate of 1·9 lb. per H.P. per hour, which is equivalent to 1·6 or 1·7 lb. with Welsh coal. The amount of water used per I.H.P. per hour was 15·8 lbs. It is a matter of considerable interest to note the close approximation of the theoretical and actual results to one another, the beauty of the lines and clearness of cut-offs in the actual

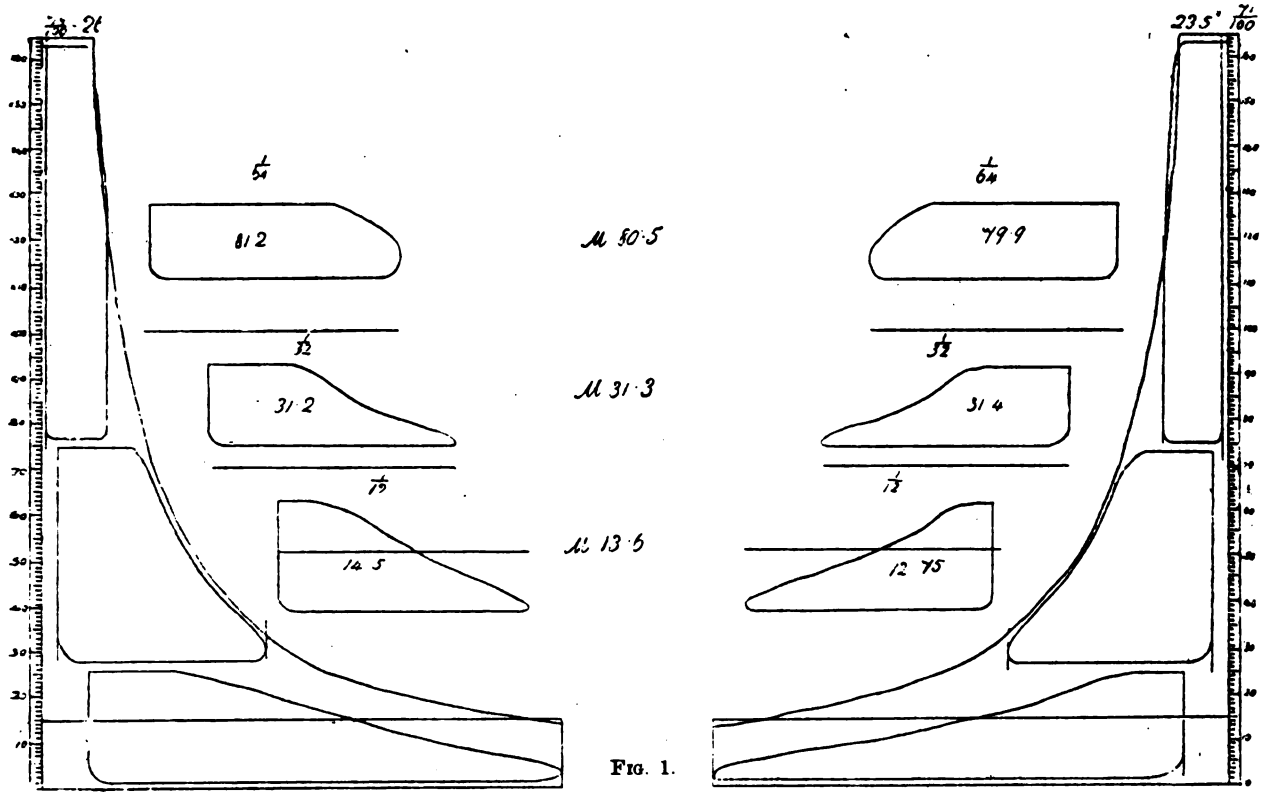


Fig. 1.

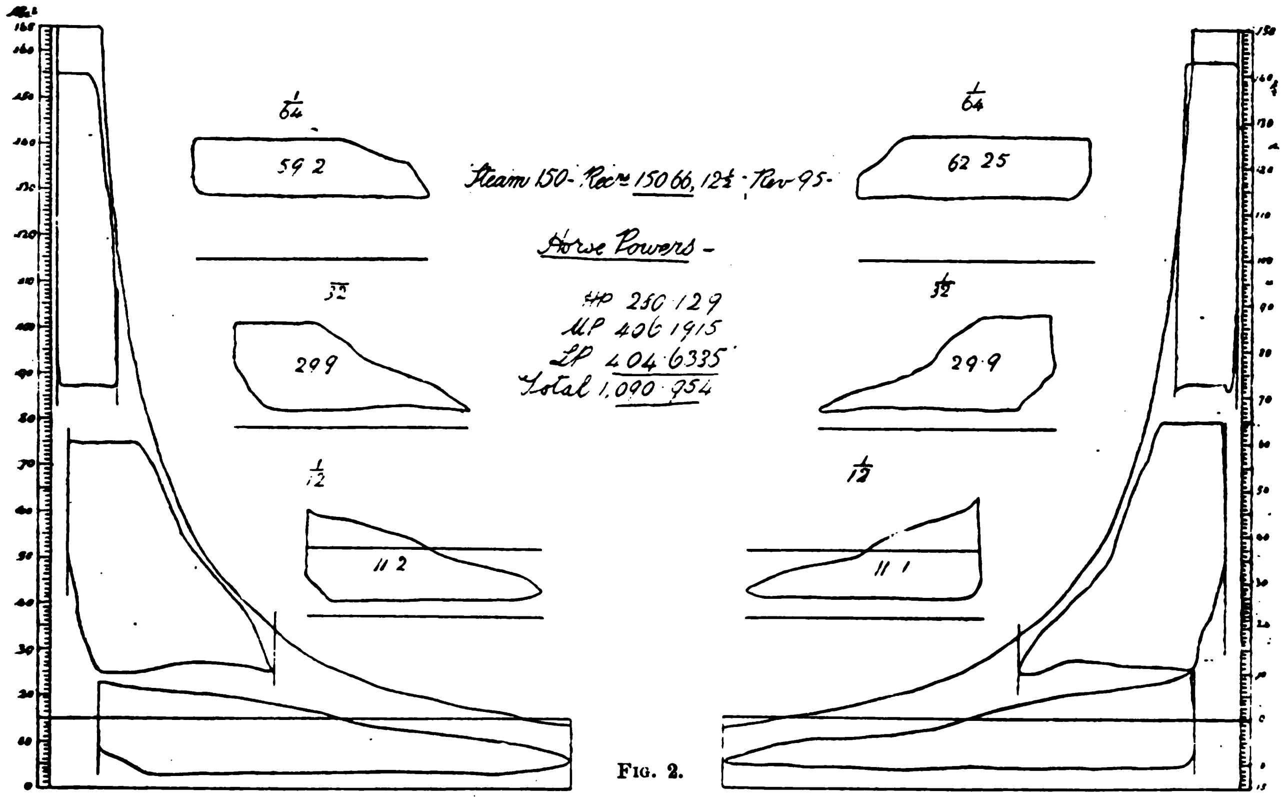


Fig. 2.

diagrams, and the good record both as regards coal and water.

We would draw particular attention to the high and mid-pressure steam lines and to the mid-pressure cut-off, both of which are evidence of good efficiency, the second being equivalent in cut-off to a Corliss valve.

It would be interesting to ascertain the reason of the drop in pressure between the high and mid-pressure cylinders; however, although this appears to be a fault, the fact remains that as a whole the result is very satisfactory.

As regards other matters, the diagrams speak for themselves, so we need not add any further description with reference thereto.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Hyades.—On May 24th Messrs. John Blumer & Co. launched at Sunderland a new steamer of the spar-decked type, specially designed to carry cattle, for Messrs. R. P. Houston & Co.'s River Plate Line. She takes the highest class at Lloyd's. Length over all, 365 ft.; breadth, 47 ft.; depth, moulded, 27 ft. 6 in. She has been built on the deep-frame system. The engines and boilers have been built by Messrs. John Dickinson & Sons, Limited, and are of the triple-expansion type, the cylinders being 26 in., 43½ in., and 72½ in. by 48in. stroke. The vessel was named *Hyades*, by Miss Hopkins, of Liverpool.

Holmgarth.—On May 24th there was launched at Southampton from the yard of Messrs. J. G. Fay & Co., Limited, the single screw steel tug *Holmgarth*, built to the order of Messrs. R. & J. H. Rea, and intended for service in Southampton waters. Her principal dimensions are:—Length, between perpendiculars, 73 ft.; breadth, moulded, 16 ft.; depth, moulded, 9 ft. She is propelled by a set of inverted direct-acting compound surface-condensing engines, with cylinders 15 in. and 30 in. diameter, and 22 in. stroke. Steam is supplied from a cylindrical return tube boiler of 10 ft. diameter by 10 ft. in length, and designed for a working pressure of 110 lbs.

Beta.—On May 25th the steel screw steamer *Beta*, built by Messrs. Wm. Gray & Co., Limited, for Mr. B. J. Van Hengal, Amsterdam, was launched at West Hartlepool. She is intended for the timber and general cargo trades, and takes Lloyd's highest class, her dimensions being: length, overall, 280 ft.; breadth, 39 ft.; depth, 18 ft. 2 in. She has a half poop, raised quarter-deck and part awning-deck, with houses on deck for cabins. The hull is built with deep framing, cellular double-bottom, and a large after-peak tank, and the equipment will be of the most improved description, including steam windlass, steam steering-gear, patent donkey boiler, four steam winches, etc. She will have triple-expansion engines made at the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, with cylinders 19 in., 30½ in., and 51 in. diameter, and a piston stroke of 36 in., and two steel boilers to work at a pressure of 160 lbs. per square inch. The ceremony of naming the ship was gracefully performed by Miss Rachel Lotinga, daughter of Mr. A. Lotinga, ship broker and owner's agent at West Hartlepool.

Chieftain.—On May 25th a tug steamer, built to the order of the Glasgow and Greenock Shipping Co., was launched by Messrs. Eltringham & Co., South Shields. The vessel, which is intended for service on the Clyde, is of the following dimensions. Length, 110 ft.; breadth, 19 ft.; and depth, 10 ft. The ceremony of naming her the *Chieftain* was performed by Miss Bessie Blanche, daughter of Mr. Richard Blanche, Greenock, manager of owners.

Wilcannia.—On May 26th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a steel screw steamer, built to the order of Mr. W. Lund, of London, making the sixth vessel built by the firm for his Blue Anchor Line, and a sister steamer to the s.s. *Narrung* and *Wakool*, belonging to the same firm. The dimensions of the vessel are as follows:—Length between perpendiculars, 400 ft.; breadth, 48 ft.; depth moulded, 31¼ ft.; classed 100 A1 Lloyd's. The boat has been specially designed for the owner's line running between London and Australia; her carrying capacity is 6,000 tons. Accommodation is fitted for 50 first-class and 50 third-class passengers. The steamer is built with full poop and topgallant forecastle, with long citadel bridge, at the forward end of which is placed accommodation for captain and first-class passengers, together with lavatories, bathrooms, and rooms for stewardess, &c.; and at the after end of this bridge accommodation is fitted for the officers, engineers, apprentices, purser, refrigerating and electrical engineers, together with officers' and engineers' mess-rooms. On top of this bridge deck a large house is built, containing berths for several first-class passengers, doctor, and steward; also bar and pantries. At the fore end of this house, and forward of the machinery space, there is a large dining saloon for first-class passengers, which is panelled out in two shades of polished oak; handsome mirrors are fitted with carved-oak caps and moulding relieved with gold, the whole of the fittings being of solid white metal. There are three dining tables with revolving chairs, also sofas, bookcases, sideboards, &c., complete. This saloon is specially lighted and ventilated with dome skylight and large sidelights all round. On the top of the main saloon is a large music-room, fitted in light oak with a number of mirrors, and tastefully decorated. This room is also lighted by a large dome skylight. In close proximity to the saloon is a large smoking-room, panelled in Australian hardwood and mirrors, luxuriously fitted with lounges, tables, &c., complete. Covering all this accommodation is a complete shade deck extending to the sides of the vessel, forming a promenade for the first-class passengers 120 ft. by 48 ft., the only erection upon which is the captain's house and steering-house. The former is handsomely fitted up in oak and mahogany, with sleeping berth, slate-top chart table, racks, &c. Accommodation for 50 third-class passengers is placed in the topgallant forecastle and under the fore end of the bridge, whilst the crew are all berthed in the full poop aft. The galley is built round the main mast on the spar deck, so as to be conveniently placed for the stewards, cooks, and crew, and is of exceptionally large dimensions and well ventilated; the range, steam, and baker's ovens, &c., are of extra large size. The steam-steering gear is by Messrs. Davis & Co., and stands in the engine-room casing at the after end, and is connected to the wheel-house on the shade deck by rods and bevelled gear, the after steering gear is of extra size and power by Mr. John Lynn, of Pallion. There are eight steam winches for working the cargo, which have been built to the owner's special requirements, with extra large drums, &c., by Mr. Robert Welford, of Pallion. Powerful steel derricks, &c., are fitted, and all gear for handling light and heavy cargoes. Abreast the main mast there are two large sidehouses connected by overhead bridge to the galley, built with complete accommodation for quartermasters, carpenters, boatswains, and the various petty officers, including messroom for same, &c. The whole vessel is entirely lighted throughout by electricity by Messrs. Troup & Curtis, of London, the whole of the forehold and fore 'tween decks (which are of a very large capacity) have been insulated by Messrs. Gregson & Co., of London, for the carrying of frozen meat, the necessary refrigerating machinery (which stands immediately above this hold) is manufactured by the Haslam Foundry and Engineering Co., of Derby. This vessel will be placed on the Admiralty list: the 'tween decks (which are exceptionally high) are pierced all fore and aft for the accommodation of troops or emigrants. Special attention has been paid to the ventilation of passengers' accommodation throughout the vessel, The main engines are by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the cylinders being 28 in., 41 in., and 78 in. by 54 in. stroke, with bronze propeller. The boilers are four in number, single-ended, working at a pressure of 180 lbs., and are fitted with Howden's patent forced draught. During construction the hull has been built under the constant inspection of Captain Ilbery, under whose command she will sail, whilst the engines have been supervised by Mr. Shanks, of London. The vessel, when considered as a passenger and cargo steamer combined, is one of the largest and finest that has been built on the Wear. The launching ceremony was successfully performed by Mrs. Mackenzie, of Melrose, who named the vessel *Wilcannia*.

Floriston.—On May 26th Messrs. Ropner & Son launched from their shipbuilding yard a very fine steel screw-steamer 325 ft. long; her machinery will be supplied by Messrs. Blair & Co., Limited. She has been built to the order of a Newcastle firm, and as she left the ways received the name of *Floriston* from Miss Adams, daughter of Captain Adams, who will take command of the steamer on completion.

Luciline.—On May 26th Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited, launched the above oil tank steamer, building to the order of Messrs. Lane & Macandrew, of London. The vessel, like her sister ship *Oriflamme*, has been constructed under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and is of the following dimensions: 335 ft. by 45 ft. by 29½ ft. moulded depth. A very powerful installation of pumping arrangements has been supplied, and electric light is fitted throughout. The engines are being erected by the Wallsend Slipway and Engineering Co., Limited, and are of the following dimensions, namely, 24 in. by 40 in. by 66 in. diameter, with a stroke of 48 in., the two large single-ended boilers working at 160 lbs. pressure. Both hull and machinery are constructed to the highest class of Bureau Veritas, and in conformity with the Suez Canal regulations.

Naudu.—On May 27th there was launched at Selby, by Messrs. Cochrane & Cooper, Limited, a steam trawler for the Grimsby fishing trade, which has been built to the order of Messrs. Baskcombe & Taylor, of Grimsby. She was named *Naudu*. The *Naudu* is the sister ship to the *Merlin*, recently built for the same firm, and is to be engined by Messrs. C. D. Holmes & Co., of Hull.

Elsie.—On May 27th there was launched at Selby by the Selby Shipbuilding and Engineering Co., Limited, a steam trawler, built to the order of the Central Steam Fishing Co., which was named *Elsie*. She is a sister ship to the *Kathleen*, recently built for the same owners.

Formby.—On May 29th there was launched from the yard of Messrs. R. Williamson & Son, Workington, a finely modelled screw-steamer, built to the highest class at Lloyd's, for Messrs. J. Edwards & Co., Liverpool. Her dimensions are:—Length, between perpendiculars 152 ft. 3 in.; breadth, 23 ft. 6 in.; depth, moulded, 12 ft. 3 in., and designed to carry 520 tons on Lloyd's freeboard. The engines are to be supplied by Messrs. Ross & Duncan, of Govan, and are of the compound type, having two cylinders 19 in. and 38 in. with a stroke of 27 in.

Cassandra.—On May 29th a new steam yacht, built and designed by Messrs. Day, Summers & Co., to the order of Mr. F. M. Huth, was launched at Southampton. The principal dimensions are as follows:—Length between perpendiculars, 130 ft.; breadth, 19 ft.; depth, 12 ft. 6 in.; tonnage (builders' measurement) 228 tons. The engines are of the triple-expansion surface-condensing type, with cylinders 11 in., 17½ in., and 28 in. diameter, and 21 in. stroke; pressure, 160 lb. The yacht was named *Cassandra*.

Manchester Importer.—On May 29th there was launched from the yard of Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, a finely modelled steel screw cattle and cargo steamer named the *Manchester Importer*, built to the order of the Manchester Liners, Limited, of which Sir Christopher Furness is chairman. The vessel is being built expressly for the Manchester Liners service from the Manchester Canal to Canada, and has a cargo capacity of 10,666 tons. She is of the following dimensions, viz.:—Length, 382 ft. by 48 ft. beam, and 36 ft. 6 in. depth, and has two masts, and is rigged fore and aft with telescopic topmasts to suit the Manchester Canal bridges, and has been built under special survey to take the highest class in Lloyd's registry. She is built to the highest grade with one steel deck, and has an iron shelter deck specially strengthened, considerably in excess of Lloyd's requirements for the Atlantic trade, extending over the whole length, and above this is a bridge deck 110 ft. long. All the available space under the shelter deck, and along each side under the bridge deck, is fitted throughout to pass the American and Canadian regulations, with the most improved and modern arrangements for carrying about 500 head of cattle. The accommodation for saloon, captain, spare staterooms, &c., is arranged on the bridge-deck in a large steel deck-house, and separate houses for officers and engineers, and the seamen; firemen under shelter deck forward, and the cattlemen's quarters are under the shelter deck aft. A cellular double-bottom is fitted all fore and aft for water ballast, and also four separate tanks under engine, and boiler space for fresh water for supplying cattle. Water ballast is also arranged to be carried in a deep cargo tank and in the after peak, giving the vessel a total water ballast capacity of over 1,600 tons. The vessel is divided into six watertight compartments by means of seven steel bulkheads, all of which extend to the upper deck. Each compartment is fitted with complete iron and wood grain divisions. A most complete system of ventilation has been arranged to ensure the safe carriage of cattle, grain, or other cargoes. The vessel has six hatches, eight powerful steam winches, and ten derricks provided for the rapid loading and discharging of cargoes. A powerful steam windlass is fitted forward for working the cables, and a combined hand and steam-steering gear of special design is fitted in a large steel wheelhouse on the after end of the shelter deck. Special steering telegraphs are fitted for navigating purposes whilst going up the canal. The vessel is lighted throughout by electricity, and will be fitted as a first-class cattle and cargo steamer, including all the most modern improvements for the Atlantic trade. The engines are being constructed by Messrs. William Allan & Co., Limited, Sunderland. They are of the inverted triple-expansion type, having cylinders 25 in., 41 in., 69 in. by 48 in. stroke, steam being supplied by three single-ended boilers 14 ft. 3 in. diameter by 11 ft. long, with a working pressure of 180 lbs. All the shafting is very considerably in excess of Lloyd's requirements. The propeller is of manganese bronze, and the auxiliary machinery is of the most modern type. As the vessel left the ways the christening ceremony was gracefully performed by Mrs. Schiff, Lowndes Square, London, wife of one of the directors of the Manchester Liners, Limited. The hull of the vessel has been specially designed and built for the Manchester Canal trade under the supervision of Mr. A. H. Walker, the machinery by Mr. J. F. Kitching, shipbuilding and engineering superintendents for Sir Christopher Furness, and also Mr. James Robinson, marine superintendent for the Manchester Liners, Limited. A duplicate of the *Manchester Importer*, now in an advanced stage of construction, is expected to be launched by the builders in July, and is to be named the *Manchester Shipper*. There was a large company present to witness the launch, including Sir Christopher and Lady Furness, Mr. and Mrs. Schiff, Major D. G. and Mrs. Irvine, Sir Edward Gourley, M.P., Mr. and Mrs. Candlish (Shotton Hall), Mr. and Mrs. Withy, &c.

Hugin.—On June 3rd there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Limited, Bill Quay, Newcastle-on-Tyne, a handsome steel screw-steamer which has been built to the order of Messrs. Bruusgaard, Kjosterud & Co., of Drammen, Norway. The vessel is of the improved single-deck type with bridge and topgallant forecastle, and is of the following dimensions, viz.:—Length, 248 ft.; breadth, 35 ft.; depth, moulded, 20 ft. 6 in. She will be rigged as a fore-and-aft schooner and fitted with telescopic topmasts. The vessel is built to the highest class, viz.—1 A1* Norwegian Veritas, and has been surveyed during construction by Mr. Lauritz M. Bodin, of Sunderland, the local representative; and also superintended by Mr. Norman Burnett, of Newcastle-on-Tyne, on behalf of the owners. The vessel will be fitted with all the latest improvements and appliances for facilitating the rapid loading and discharging of cargo, general working and navigating: including combined steam and hand-steering apparatus amidships, screw gear aft, direct steam windlass, powerful steam winches, &c. The saloon, captain's berth, spare state rooms, &c., are in a large house on bridge deck amidships, with chart room and flying bridge above; the officers' accommodation being in house aft on main deck, whilst the crew are berthed in the topgallant forecastle; water ballast is provided in the cellular double bottom, all fore and aft. Her engines have been constructed and will be fitted by the North-Eastern Marine Engineering Co., Limited, at the Northumberland Engine Works, Wallsend-on-Tyne. These are of the improved triple-expansion type, having cylinders 18½ in., 30 in., and 49 in. diameter, respectively, with a stroke of 33 in.; steam being supplied by a large steel multitubular boiler, working at 160 lbs. pressure per square inch. As the vessel left the ways she was christened *Hugin* by Miss Minnie Skinner, of South Shields. When completed the steamer will be commanded by Captain Fornebo, of Christiania, Norway. This is the fourth vessel recently constructed by the builders for Messrs. Bruusgaard, Kjosterud & Co., whilst they have a fifth steamer in course of construction on the stocks for the same owners.

Enidwen,—On June 6th there was launched by Messrs. John Readhead & Sons, at West Docks, South Shields, a new screw-steamer, built to the order of Messrs. W. H. & C. T. Jones, Cardiff. The vessel, which is 353 ft. long, 46 ft. 6 in. broad, and 27 ft. 4 in. in depth, is of the improved single-deck type and classed A1 at Lloyd's under special survey. The steamer will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 24 in., 40 in., and 65 ins., by 45-in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch. The vessel was named the *Enidwen* by Miss Jones, daughter of Mr. William Jones, of Cardiff, senior of the firm.

Portugal.—On June 7th Sir Raylton Dixon & Co., Limited, launched from Cleveland Dockyards, Middlesbrough, a fine steel screw mail and passenger steamer built to the order of Senhores Empreza Nacional de Navegacao a Vapor, of Lisbon. She is built to Lloyd's highest class, spar-deck rule, her principal dimensions being: 377 ft. by 45 ft. 6 in. by 29 ft. 9 in., and has a deadweight carrying capacity of over 5,000 tons. The upper decks are of steel, sheathed with teak. Accommodation for 80 first-class passengers will be provided for amidships with large dining saloon, &c., in house aft. The 250 second-class passengers will be accommodated on main deck. The whole of the accommodation has been designed and ventilated to meet the passenger requirements in a tropical climate. Triple-expansion engines will be supplied by Messrs. Thos. Richardson & Sons, Limited, of Hartlepool, having cylinders 28 in., 46 in., 77 in., by 48 in. stroke, provided with steam by two large double-ended boilers, working at 180 lbs. pressure. The vessel has been built under the supervision of Mr. T. C. Laws, of Liverpool. On leaving the ways she was gracefully named *Portugal* by Mrs. T. C. Laws.

Garonne.—On June 8th there was launched from the shipbuilding yard of Messrs. Robert Stephenson & Co., Limited, Hebburn, a finely-modelled screw steamer, the first of two to the order of the United Steamship Co., of Copenhagen. The ship, which is of the raised quarter-deck type, is of the following dimensions:—Length, between perpendiculars, 250 ft.; breadth, moulded, 35 ft.; depth, moulded, to main deck, 18 ft. 4 in., and depth, moulded, to quarter-deck, 22 ft. 4 in. The ship, which is built to the highest class in Bureau Veritas, is to be fitted out for the French wine trade. She has a cellular double bottom all fore and aft for water ballast, and has upper and lower decks of steel. The bow has been specially strengthened for ice to obtain Veritas P.R. class. She has a vertical donkey boiler, four powerful steam winches, a steam windlass, and steam and hand-steering gear. The crew are berthed forward under the topgallant forecastle, and the saloon and staterooms and the officers' and engineers rooms are in an upper bridge above the main bridge. All the rooms throughout are heated by steam. The engines, which are of the triple-expansion type, supplied with steam by two large single-ended boilers, are also supplied by the builders. The ship has been constructed under the supervision of Captain Rabe, and the engines under that of Mr. Fricke, the representatives of the owners. As the ship left the ways she was gracefully named *Garonne* by Miss Walker, daughter of the general manager of Messrs. Robert Stephenson & Co., Limited.

Manchester Corporation.—On Thursday, June 8th, Messrs. Furness, Withy & Co., Limited, launched from their Middleton Shipyard, West Hartlepool, the finely-modelled steel screw cattle and cargo steamer named the *Manchester Corporation*, built to the order of the Manchester Liners, Limited, of which Sir Christopher Furness is chairman. The vessel is built expressly for the Manchester Liners service from the Manchester Canal to Canada. Her dimensions are:—Length, 445 ft.; beam, 48 ft.; depth, moulded, 34 ft. The vessel has four masts, and is rigged fore and aft, with telescopic topmasts and funnel to suit the Manchester Canal bridges, and the scantlings of the vessel are considerably in excess of Lloyd's highest class. The *Manchester Corporation* is of the three-deck type, with two steel decks laid all fore-and-aft, and has poop, bridge, and forecastle, with strengthened wood shelter-deck between erections, and the vessel is strengthened considerably above Lloyd's requirements to suit the Atlantic trade. All the available space under the shelter-deck, upper deck, and bridge is fitted throughout to pass American and Canadian regulations, with the most improved and modern arrangements for carrying 756 head of cattle. The accommodation for the captain in the saloon and spare staterooms, &c., is arranged on the bridge deck in a large steel deckhouse, with separate house for officers. The engineers are housed at the fore end of bridge, the seamen and firemen under the forecastle, and the cattlemen in the poop. A cellular double-bottom is fitted all fore and aft for water ballast, and there are also four separate tanks under engine and boiler space for fresh water for cattle supply. A specially strengthened deep tank is fitted just aft of the engine room, and both fore and after peaks are fitted for water ballast, giving a total ballast capacity of 1,700 tons. The vessel is divided into nine watertight compartments by means of eight steel bulkheads. Each compartment is fitted with complete grain divisions. A most complete system of ventilation has been arranged to ensure the safe carriage of cattle, grain, or other cargoes. The vessel has eight hatches, eight powerful steam winches and 16 derricks provided for the rapid loading and discharging of cargoes. Special attention has been devoted to the bunkering arrangements of the vessel so that the bunkering can be carried out in an efficient manner. A powerful steam windlass is fitted forward for working the cables, and combined hand and steam-steering gear of a special design is fitted in the after end of the poop. The vessel is lighted throughout by electricity, and will be fitted as a first-class cattle and cargo steamer, including all the most modern improvements for the *Atlantic trade. The* engines will be supplied by Messrs. Sir C. Furness, Westgarth & Co., Limited, Middlesbrough; they are of the inverted triple-expansion type, having cylinders 28 in., 46 in., 78 in. by 54 in. stroke, steam being supplied by three single-ended boilers 14 ft. 9 in. by 12ft. diameter, with a working pressure of 190 lbs, Howden's forced draught being also fitted in connection with the boilers. The ceremony of christening the vessel *Manchester Corporation* was gracefully performed by the Lady Mayoress of Manchester.

Ormley.—On June 8th Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a large steel screw-steamer, the particulars of which are as follow:—372 ft. by 48 ft. by 30 ft. 11 in. depth, moulded. She is built to the highest class in Lloyd's, spar-deck rule, with poop, bridge, and topgallant-forecastle; water ballast in cellular double-bottom fore and aft, also in peaks. She will be equipped with seven large double-powered steam winches, patent direct steam windlass, patent steam-steering gear, portable 10-ton derricks, screw gear aft, complete set of shifting boards for grain carrying, and all the latest improvements. She is rigged as a fore-and-aft schooner, to the Manchester Canal requirements. The accommodation for captain, officers, and engineers is in the central deckhouse on bridge, the crew being berthed in the forecastle. The main engines have been constructed by Messrs. William Allan & Co., Limited, Sunderland, the cylinders being 23½ in., 38½ in., 68 in. by 48 in. stroke, three large boilers working at 200 lbs. pressure. This vessel has been built to the order of the North of Ireland Steamship Co., Limited, Belfast (Mr. W. R. Rea, managing director), and under the superintendence of Mr. Joseph Lewis. As she left the ways she was gracefully christened the *Ormley*, by Miss Head, representing her mother, the Mayoress of Thornaby. This is the fourth vessel built by Messrs. Craig, Taylor & Co. for the owners.

Banderas.—On June 9th Messrs. William Pickersgill & Sons launched at Southwick, Sunderland, a steel screw cargo steamer of the single-decked type, built to the order of the Compania Naviera Vascongada, of Bilbao, of which Mr. Felix de Abasolo is managing director. The dimensions of this vessel are as follows:—Length, 295 ft.; breadth, 43 ft.; depth, moulded, 21 ft. She has been built to Lloyd's highest class under special survey, and has been designed to carry about 3,600 tons deadweight. The machinery and boilers are to be supplied by Messrs. Geo. Clark, Limited, of Southwick, the engines being of the triple-expansion type, having cylinders 21 in, 35 in., and 57½ in., with 39-in. stroke, and two large steel boilers with a working pressure of 160 lb. She was named *Banderas* by Miss Young, daughter of Mr. Young, of the firm of Messrs. Cairns, Young & Noble, of Newcastle-on-Tyne.

Wamba.—On June 10th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions—112 ft. by 21 ft. by 11 ft. 6 in. depth of hold, built to the order of the United Steam Fishing Co., Limited, Grimsby. Triple-expansion engines will be fitted by Messrs. C. D. Holmes & Co., and the vessel will be complete with all the most modern appliances for trawling. Miss J. Chesman named the vessel the *Wamba*, and after the ceremony the company adjourned to the offices of the builders to luncheon.

Floriken.—On June 21st Mr. Joseph Scarr launched from his yard at Grovehill, Beverley, a steel tug boat of the following dimensions:—Length overall, 69 ft.; beam, moulded, 16 ft. 5 in.; depth amidships, 9 ft. 3 in. She was built to the order of Mr. J. Constant, of London, and is the fourth Mr. Scarr has built for him. On leaving the ways she was christened *Floriken* by Mr. Marshall.

Swindon.—On Thursday afternoon, June 22nd, Messrs. Richardson, Duck & Co. launched from their yard a steel screw-steamer of the following dimensions:—Length overall, 351 ft. 9 in.; breadth extreme, 48 ft.; depth, moulded, 28 ft. 4 in.; tonnage, gross, about 3,860 tons. This vessel, which has been built to the order of Messrs. Evan Thomas, Radcliffe & Co., Cardiff, will class 100 A1 on Lloyd's register, and has been built under special survey. She is of the three-deck type with one deck laid, having poop bridge extending from mainmast to fore mast and topgallant-forecastle. Accommodation for captain and officers is provided in poop, engineers being berthed in iron sidehouses on bridge deck, and crew in topgallant-forecastle, which has been specially fitted with patent galvanised iron berths and a bathroom. A cellular double-bottom all fore and aft and fore-and-aft peak tanks are fitted for water ballast and equipment includes six steam winches, an auxiliary main boiler by Blair & Co. of 160 lbs. working pressure, steam windlass, stockless anchors, steam-steering gear, and all latest appliances for the economical and safe working of the vessel. The engines, by Messrs. Blair & Co., have cylinders 24 in., 40 in., and 66 in. by 45 in. stroke, steam being supplied by two single-ended boilers of 160 lbs. pressure. As the vessel left the ways she was named *Swindon* by Miss Maud Kitching, daughter of Mr. A. E. Kitching, Great Ayton.

Rowena.—On June 23rd Messrs. Wm. Gray & Co., Limited, launched the large steel screw-steamer *Rowena*, which they have built to the order of Messrs. Herskind & Co., of West Hartlepool. She is the 26th vessel which the builders have supplied to the order of Messrs. Herskind & Co. Her principal dimensions are :—Length, over all, 336 ft.; breadth, 47 ft.; and depth, 24 ft. 10 in., and she is built to Lloyd's highest class with poop, bridge, and forecastle, and fore-and-aft schooner rig. Very tasteful cabin accommodation is provided under the poop. The engineer's rooms are in houses on the bridge, and the crews' berths forward. The hull is built with deep frames and a cellular double bottom and after peak tank for water ballast. Steam windlass, steam-steering gear amidships, screw gear aft, steam winches, patent donkey boiler, and the whole of the outfit are of the most improved description. The engines are by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, on the triple-expansion system, with cylinders 24 in., 38 in., and 64 in. diameter, and 42 in. stroke, and two large single-ended boilers to work at 160 lbs. pressure per square inch. The ship has been built under the superintendence of Captain Petersen, and the machinery under that of Mr. J. R. Fothergill, on behalf of the owners. The ceremony of naming the *Rowena* was gracefully performed by Mrs. Herskind, of West Hartlepool, the wife of one of the owners.

Elswick Park.—On June 24th Messrs. W. Gray & Co., Limited, launched a large steel screw-steamer for the Elswick Steamship Co., Limited, Newcastle-on-Tyne, Messrs. Werdner-Hopkins & Co., managers. She will take the highest class in Lloyd's, and is of the following dimensions, viz.—Length, over all, 341 ft.; breadth, 47 ft.; depth, 27 ft. 4 in., with long bridge, poop, and top-gallant forecastle. The saloon, state-rooms, captain and officers' rooms, &c., will be fitted up in the poop, the engineers' accommodation in houses on the bridge-deck, and the crews berth in the forecastle. The hull is built with deep frames, cellular double bottom, and aft peak ballast tank, six steam winches, steam steering gear amidships, and hand screw gear aft, patent direct steam windlass, two patent donkey boilers, shifting boards throughout, stockless anchors, telescopic masts, with fore-and-aft rig boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, having cylinders 25 in., 40 in., and 65 in. diameter, with a piston stroke of 42 in., and large steel boilers for a working pressure of 160 lbs. per square inch. The ship and machinery are being completed under the superintendence of Mr. Walter Sage, of Hull, on behalf of the owners. The ceremony of naming the vessel *Elswick Park* was gracefully performed by Miss Marjorie Hopkins, daughter of the managing owner.

Surrey.—Lately the *Surrey*, a large four-masted steel screw steamer, constructed by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, to the order of Messrs. Wm. Milburn & Co., London, has been launched at Hebburn-on-Tyne. Her principal dimensions are:—Length, over all, 435 ft.; breadth, 54 ft.; depth, 40 ft. to shelter deck. The vessel has been built in excess of the highest class at Lloyd's, and is intended for carrying frozen meat from the Colonies. The engines have been built by Messrs. R. and W. Hawthorn, Leslie & Co., Limited, and are of the triple-expansion surface-condensing type, with cylinders 30 in., 48 in., and 78 in. diameter, and 54 in stroke. The vessel was christened *Surrey*.

LAUNCHES.—Scotch.

Seagull.—On May 8th there was launched at Rutherglen, for the Manchester and Liverpool Transport Co., Limited, Manchester, a steel schooner-rigged steamer, of about 200 tons gross, named the *Seagull*.

Craigellachie.—On May 23rd there was launched by Messrs. A. Rodger & Co., at Port-Glasgow, a steel-screw steamer of 3,300 tons gross, to carry 5,500 tons deadweight, for Messrs. Russell, Huskie & Co., Leith. Her dimensions are :—Length, 326 ft.; breadth, 48 ft.; depth, 26 ft., 4½ in. The ceremony of naming the vessel *Craigellachie* was performed by Mrs. Russell, wife of one of the owners. Messrs. Hall, Brown, Buttery & Co., Glasgow, will supply the machinery.

Noyra.—On May 24th Messrs. Paul Jones & Son launched at Gourock the racing cutter *Noyra* for Mr. M. Greenlees, jun., Paisley. The *Noyra* belongs to the new 20-ton one-design Clyde class, designed by Mr. Alfred Mylne, Glasgow, of which five have been built for this season. Her principal dimensions are :—Length over all, 50 ft.; on water line, 35 ft.; beam, 11 ft.; and drawing 8 ft.

Teodoro de Larrinaga.—On Wednesday, May 24th, Messrs. Russell & Co., Kingston Shipbuilding Yard, Port-Glasgow, launched a steel screw-steamer named *Teodoro de Larrinaga*. Length 345 ft., by beam 49 ft. 9 in., by depth 28 ft. 6 in., and carrying about 6,400 tons deadweight on Lloyd's summer freeboard. This vessel was purchased by Messrs. Larrinaga & Co., of Liverpool. After launch she was towed to the Victoria Harbour, Greenock, where she will have her engines put on board, and be completed ready for sea. Her engines, which are built by Messrs. Rankin & Blackmore, of Greenock, are 25 in., 41 in., 67 in., by 45 in. stroke, and are fitted with Howden's forced draught. The steamer is of the spar-decked type, and is fitted with the most modern improvements for rapid handling and discharge of cargo, the accommodation for all officers being on the top of the bridge. She was completed under the superintendence of Captain L. de Ojinaga.

Vienna.—On May 25th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, the first of two steamers which are being built for Messrs. Gow, Harrison & Co., Glasgow. The vessels are designed for general trade, having eight steam winches, long double derricks, &c., for the rapid handling of cargo. They are classed in the British Corporation's highest class. The principal dimensions are 376 ft. by 48 ft. by 29 ft., moulded; she measures about 4,100 tons gross, her deadweight carrying capacity is 6,700 tons. The saloon, captain's room, and staterooms are arranged in a large deck house on the bridge deck. The officers' and engineers' rooms are placed alongside the machinery casings on bridge deck. The crew and cattlemen are berthed forward. The machinery, which is being supplied by the builders, is on the triple-expansion principle, the cylinders are 25 in., 41 in., 67 in., by 48 in. stroke, steam being supplied by two large boilers at a working pressure of 180 lbs. and fitted with Howden & Co.'s forced draught. The superintendence was conducted under Mr. George Macfarlane, of Glasgow. As the vessel left the ways she was gracefully named the *Vienna* by Mrs. Bilsland, 28, Park Circus, Glasgow. thereafterwards proceeding to the harbour to take in her machinery.

Domingo de Larrinaga.—On May 26th Messrs. Robert Duncan & Co., Limited, launched at Port-Glasgow the steel screw-steamer *Domingo de Larrinaga*, built to the order of Raeburn & Verel, Glasgow, and transferred by them to F. D. Larrinaga & Co., Liverpool. Dimensions ; 376 ft. by 48 ft. by 29 ft., moulded; about 6,600 tons deadweight. Triple-expansion engines by Hall-Brown, Buttery & Co., Govan, Glasgow. Cylinders, 27 in., 43 in., 72 in., by 48 in. Two boilers with Howden's forced draught.

Ytoroi.—On May 26th Messrs. William Simons & Co., Limited, launched complete from their works at Renfrew the second of two powerful dredging vessels which they have constructed to undertake extensive dredging operations in connection with the improvement of Port Arthur and Talienwan. The vessel has been built under the direction of Mr. Totshyski, inspecting engineer, assisted by Mr. Johnson. The dredger, in addition to being provided with a chain of buckets for discharging into barges alongside, is fitted with a sand suction pump, also a mud discharging pump, to which is attached fully 2,000 ft. of shore discharging pipes, carried on floating pontoons having flexible joints. The vessel is capable of dredging and discharging 1,000 tons of spoil per hour, and of working to a depth of 40 ft. below the water level. Two pair of compound surface-condensing engines are fitted for propelling the vessel at a speed of seven knots per hour. It is constructed in accordance with the rules of Bureau Veritas for the highest class for a vessel of this type. Electric light installation is provided for working day and night. A repairing-room is also fitted on board, with turning lathe, drilling and planing machine, &c. As the vessel left the ways she was named *Vtoroi* by Mrs. Totshyski.

Gleniffer.—On May 27th Messrs. David & William Henderson & Co. launched at Partick, on the Clyde, a large schooner yacht, which they have built for Mr. James Coats, Ferguslie House, Paisley, from designs and under the special supervision of Mr. G. L. Watson. The yacht is built of steel, to class 100 A1 in Lloyd's Yacht Register; has a length over all of 185 ft., with a yacht measurement tonnage of about 500 tons, and was named *Gleniffer*.

Mingary.—On May 27th the Ailsa Shipbuilding Co. launched at Troon a steel screw steam yacht, designed by Mr. G. L. Watson for Mr. C. D. Rudd, of Shielbridge, by Fort William. Her dimensions are:—Length over all, 211 ft.; length on load water line, 175 ft.; breadth, moulded, 27 ft. 3 in.; depth, moulded, 15 ft. 6 in.; tonnage, about 650 tons, yacht measurement. The engines, which are by Messrs. Dunsmuir & Jackson, are of the triple-expansion type. The yacht was named *Mingary*.

Sirdar.—On May 27th the Grangemouth Dockyard Co. launched from their yard at Grangemouth the steel screw-steamer *Sirdar*, built to the order of Messrs. Orders & Handford, of Newport, for the Orders & Handford Steamship Co., Limited. This vessel is the second built for Messrs. Orders & Handford by the Grangemouth Dockyard Co. She is of exceptionally strong construction, on the bulb angle frame and stringer principle, providing holds clear of obstruction, with large hatches for self-trimming. The *Sirdar* is of the single-deck type, with bridge and forecastle, and is fitted with the most modern appliances for rapid and economical working. The dimensions of the vessel are: 240 ft. by 36 ft. 6 in. by 15 ft. 5 in., and the deadweight carried is 2,200 tons on Lloyd's summer freeboard. Triple-expansion engines, having cylinders of 19 in., 30½ in., and 50 in. by 36 in. stroke, with a large steel boiler working at 160 lbs. pressure, will be supplied by Messrs. Dunsmuir & Jackson, of Govan. The construction of the vessel has been superintended by Mr. Boddy, consulting and superintendent engineer, of Newport. As the vessel took the water the naming ceremony was gracefully performed by Miss Clotilde James, daughter of Mr. Christopher James, of Swansea.

Tayside.—On May 27th Messrs. Gourlay Brothers & Co.' Camperdown Shipyard, Dundee, launched the steam trawler *Tayside*, built for the Tay Trawling Co., Limited. Principal dimensions 105 ft., by 20 ft., by 11 ft. moulded. Gross tonnage 137, class 100 A1 at Lloyd's. Schooner-rigged and of the usual flush-deck type. Holds fitted up with fish pounds and boards. and a large cross bunker and feed-water tank for boilers. Trawling gear on the "Otter" system. Machinery, supplied by the builders, consists of a set of triple-expansion engines, and a large single-ended boiler, which is designed to give a speed of between 11 and 12 knots on trial.

Algarve.—On May 29th there was launched by Messrs. Lobnitz & Co., Limited, at Renfrew, a screw-steamer of 1,274 tons, for the United Steamship Co., Copenhagen. The vessel is fitted by the builders with triple-expansion engines of 1,400 H.P. On leaving the ways the vessel was named *Algarve* by Miss M'Call.

Waverley.—On May 29th Messrs. A. & J. Inglis, Glasgow, launched a new passenger steamer for the North British Steampacket Co., named the *Waverley*. This vessel is of larger dimensions than any other of the company's fleet, and is intended for the daily excursion around Bute which proved so popular last season, and for the evening run to Kirn, Dunoon, and Rothesay. The *Waverley* has a spacious dining cabin under the main deck aft, a comfortable tea-room at entrance to deck saloon, and has accommodation for a large number of tourists. She will shortly be placed on the station in connection with fast trains to Craigendoran.

Claughton.—On May 30th there was launched from the shipbuilding yard of Messrs. John Scott & Co., at Kinghorn, a steel twin-screw passenger ferry steamer for the County Borough of Birkenhead Corporation Ferries. The vessel's dimensions are as follows:—Length, 150 ft.; breadth on water line, 38 ft.; breadth on main deck, 41 ft.; depth, moulded, 11 ft. 9 in. She is handsomely fitted up, and in conjunction with her sister ship the *Lancashire* launched by the same builders on February 8th, is far ahead of anything presently running on the Mersey river. The promenade deck is about 133 ft long, and is fitted with sparred seats all round, made buoyant by airtight cylinders, so that in the event of the vessel foundering the seats would float off, and so act as life rafts. The captain's and steersman's platforms are on this deck, and each are fitted up with the latest improvements in steering gear, telegraphs, &c. She has a complete installation of electric light. The engines are of the twin quadruple-expansion type of the Yarrow-Tweedie patent, and are a fine set, capable of driving the vessel at 12½ knots, and reflect great credit on Mr. Weir, the engineering manager of Messrs. John Scott & Co. The launch took place at 6.15 p.m., and as the vessel began to glide down the ways she was gracefully named the *Claughton* by Miss Crawford, of Abden Villa, Kinghorn. The vessel was launched with steam up, and immediately steamed off to Burntisland Dock.

Kelvingrove.—On May 30th Messrs. Archibald McMillan & Son, Limited, Dumbarton, launched the steel-screw steamer *Kelvingrove*, of 5,000 tons carrying capacity, built to the order of the Glasgow Steamship Co. The dimensions are 345 ft. by 45 ft. by 26 ft. 9 in. to main deck, above which there is also fitted a complete shelter deck. The decks are being fitted for cattle, and the system adopted for water service and ventilation is of the most perfect description. She is being fitted with triple expansion machinery for a 10¼ knot sea service, and is amply provided with the most modern appliances for the rapid handling of cargo. Her accommodation for captain, officers, and engineers is all on top of shelter deck amidships, the crew being berthed in the poop, and the cattlemen forward. The naming ceremony was gracefully performed by Mrs. John Albert Black, Duneira, Row. The vessel and machinery have been built to Lloyd's highest class, and under the superintendence of Lloyd's surveyors and Mr. George McFarlane, of Glasgow.

Triton and **Oberon.**—On May 31st Messrs. Scott & Sons launched at Bowling on the Clyde two screw lighters of dimensions 66 ft. 6 in. by 18 ft. 3 in. by 9 ft. 6 in., moulded, built to the order of Messrs. Richard Munro & Co., Glasgow. Compound tandem engines are to be fitted on board by Messrs. Walker, Henderson & Co., Bishop Street, Glasgow. On moving down the ways the steamers were named *Triton* and *Oberon* respectively by Miss Munro.

Eemstroom.—On May 31st Messrs Carmichael, Maclean & Co., Greenock, launched from their shipbuilding yard, the steel screw-steamer *Eemstroom*, to the order of a firm in Holland. The dimensions are:—Length, 235 ft. 3¾ in.; breadth, 33 ft.; depth, moulded, 17 ft.; with a deadweight capacity of about 1,000 tons, and a gross tonnage of 1,300 tons. The vessel has been built to Bureau Veritas highest class, is of the well-deck type, and is fitted with cellular double bottom all fore and aft, with the exception of the space under the boilers, and is furnished with all modern appliances for the quick working of ship and cargo, which include three steam winches, steam windlass, and steam steering-gear, and is also fitted with electric light. Under the bridge deck there is accommodation for passengers, captain, and officers, and under the forecastle deck for crew. The engines will be supplied by Messrs. Muir & Houston, Limited, Glasgow—triple-expansion; 20 in., 23 in., and 55 in., by 36 in. stroke; and two large boilers, &c. The christening ceremony was performed by Miss Doris Carmichael, Ardenlee, Greenock.

Neptuno.—On June 1st there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a finely modelled steel twin-screw steamer, named *Neptuno*, designed for passenger and cargo service on the River Amazon. The vessel is very complete in every respect, all the woodwork being of selected teak. Accommodation has been provided in staterooms for 44 first-class passengers. A complete installation of electric light has been fitted up, including search light, and several large electric fans are placed in convenient positions. The principal dimensions are:—Length, 160 ft.; breadth, 32 ft.; depth to promenade deck, 17 ft. 4 in. After the launch the vessel was towed to Glasgow, where Messrs. Hall-Brown, Buttery & Co. will fit two sets of compound engines of large power.

Auchenarden.—On Thursday, June 1st, Messrs. Russell & Co., Kingston Shipbuilding Yard, Port-Glasgow, launched a steel spar-deck screw-steamer named *Auchenarden* to the order of the Auchen Steamship Co., Limited, Glasgow, of which Mr. T. Paterson Purdie is manager. Her dimensions are 340 ft. by 46 ft. by 28 ft. 6 in., with a deadweight carrying capacity of about 5,800 tons on Board of Trade summer freeboard. She is built to the highest class at Lloyd's, and has all accommodation for officers and engineers on top of bridge; has poop, bridge, and topgallant forecastle; and provision is made to enable the vessel to carry grain in bulk. After lunch the vessel was towed to the Victoria Harbour, Greenock, where her machinery will be put on board by Messrs. Rankin & Blackmore. Her engines are 23 in., 39 in., 65 in., by 45 in. stroke. She has been constructed under the superintendence of Mr. Peter Jackson, consulting engineer, Glasgow, assisted by Captain Peat, who is to command the vessel.

Nickolaeiff.—On June 6th Messrs. Fleming & Ferguson, Limited, Paisley, launched from their yard the powerful self-propelling bucket-ladder dredger *Nickolaeiff*, built to the order of the Imperial Russian Government. She is to be employed in carying out improvements on the ports of the Sea of Azov. She is built to cut her own flotation, and will be equipped with all the most modern appliances.

Amadavat.—On June 7th Messrs. Taylor & Mitchell launched at Greenock a steam trawler 108 ft in length, 21 ft. in breadth, and 12 ft in depth, moulded, for Messrs. J. Chant & Paddon, Plymouth. The vessel was named *Amadavat*, and will be supplied with triple-expansion engines by Messrs. Tindall & Co., Hull

Knowsie.—On June 8th a steam trawler, named the *Knowsie*, was launched by Messrs. John Duthie & Co., Montrose, for the Frazerburgh and North of Scotland Trawling Co., Limited,

Commander.—On June 8th Messrs. Hawthorns & Co., Limited, launched at Leith the first of two steam trawlers which they are at present building for Mr. Thomas Devlin, jun. She will be fitted with triple-expansion engines, and was christened *Commander*.

Golden Eagle.—On June 9th Messrs. Ramage & Ferguson, Limited, launched a full-powered steam yacht, built to the order of Sir Samuel E. Scott, Bart., Sundridge Park, Bromley, Kent, from the design of Messrs. G. L. Watson & Co., of Glasgow. The principal dimensions are:—Length, 150 ft. on water line; breadth, 24 ft. 10 in.; and depth, moulded, 15 ft. 6 in. The machinery, constructed by the same firm, consisting of a set of triple-expansion engines, having cylinders 14 in., 22 in., 36 in. diameter by 24 in. stroke, steam being supplied from a large multitubular boiler, working at a high pressure. The yacht's deckhouses and cabins are to be fitted up in a most luxurious manner, and when finished she will be a decided acquisition to the yachting fleet, having all the most modern improvements fitted. On leaving the ways the vessel was named *Golden Eagle* by Lady Farquhar, mother of the owner. The builders entertained a company after the launch, when the toasts usual on such occasions were duly honoured. Lady Farquhar replied personally to the toast of her health.

Duke of Rothesay.—On June 9th there was launched from the Caledon Shipbuilding and Engineering Co.'s yard, Dundee, a new steamer for the Dublin and Glasgow Steam Packet Co. (the Duke Line). The vessel has been specially designed for the cross-Channel service and for the conveyance of passengers, cattle, and general cargo. Her dimensions are:—Length, 276 ft.; breadth, 35 ft.; depth, 23 ft. 9 in.; gross tonnage, 1,250. The engines are of the triple-expansion type, and there are two large double-ended boilers with a working pressure of 180 lb. per square inch. The vessel was christened *Duke of Rothesay* by Miss Macnie, daughter of the chairman of the owning company.

Undine.—On June 14th Messrs. Mackie & Thomson launched at Govan the steam trawler *Undine*, which they have built for the South African Fisheries Co., Limited. The firm is new, having been formed recently for the purpose of developing the steam fishing industry off Cape Colony, and the *Undine* is their first vessel. The *Undine* is a steam trawler of 185 tons gross, 105 ft. in length, 21 ft. in breadth, and 11 ft. 7 in. in moulded depth. Triple-expansion engines of 450 I.H.P., and with cylinders of 12 in., 19½ in., and 32 in. diameter respectively, will be provided by Mr. W. V. V. Lidgerwood, Coatbridge, with boilers constructed for a pressure of 180 lbs. per inch, by Messrs. Muir & Houston, Kinning Park.

Granit.—On June 15th there was launched from the shipyard of Messrs. S. McKnight & Co., Limited, Ayr, the s.s. *Granit*, a vessel which has been constructed by the above mentioned firm for Norwegian owners. The *Granit* is a vessel of about 700 tons and is to be fitted with powerful machinery by Messrs. McKie & Baxter, engineers, Govan. She is a vessel of the raised quarter-deck type, and is specially strongly constructed for service amongst ice. After the launch the vessel proceeded to Glasgow to receive her machinery.

Screw-Steamer.—On June 16th Messrs. Russell & Co., shipbuilders, Port-Glasgow, launched a spar-decked screw-steamer of 6,400 tons deadweight carrying capacity on Board of Trade summer freeboard. The dimensions are:—Length, 345 ft.; breadth, 49 ft. 9 in.; depth, moulded, 28 ft. 6 in. The vessel is meantime to builders' account. Messrs. Blackwood & Gordon, Port Glasgow, will supply triple-expansion engines.

Wallsend.—On June 19th there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a finely modelled steel screw-steamer of the following dimensions:—Length, 165 ft.; breadth, 24 ft.; depth, moulded, 13 ft. 6 in. The vessel is to the order of the Newcastle Wallsend Coal Co., Sydney, and is intended for their coasting trade, and has been built considerably in excess of Lloyd's highest class. The naming of the steamer *Wallsend* was gracefully performed by Mrs. French, Greenock. After the launch the vessel was taken to Greenock, where Messrs. Kincaid & Co. will fit machinery of large power. Captain C. A. Colonna has superintended the construction of the steamer.

Ben Venue and **Ben More**—On June 21st there was launched by Messrs. Hall, Russell & Co., Aberdeen, two trawlers built to the order of the North British Fishing Co., Limited, Aberdeen. The vessels, which were named the *Ben Venue* and *Ben More*, are 160 tons gross register. They will be fitted with triple-expansion engines of 320 I.H.P.

Hopper Barge.—On June 22nd Messrs. W. Simons & Co., Limited, Renfrew, launched complete from their yard the second of three steam hopper barges which they are constructing to the order of the Russian Government. This barge has a hopper capacity of 400 tons and is propelled by one pair of compound surface-condensing engines of 400 I.H.P., steam being supplied from one return multitubular boiler of 120 lbs. working pressure. Cabins for officers and crew are comfortably fitted up on board, and an installation of electric light is provided for night work. The vessel was constructed under the inspection of, and is classed by, Bureau Veritas.

Border Knight.—On June 22nd Messrs. David and W. Henderson & Co., Partick, launched a large steel screw cargo steamer which they have built for the Border Union Steamship Co., Limited, for which Messrs. James Little & Co., Glasgow, are managing owners. The vessel is 360 ft. long, 46 ft. broad, and 28 ft. 5 in. deep; and has a gross tonnage of about 3,900 tons, and will be classed in Lloyd's 100 A1 three-deck rule. She has been fitted with all the latest improvements to insure the rapid and safe working of the large cargo which she has been designed to carry, including powerful winches, and also large derricks at the hatches. The saloon and officers' accommodation is on the fore end of the bridge deck, and a teak chart-room and wheelhouse have been built above this, with a bridge, which will give every facility to the officers in navigating the vessel. A set of triple-expansion engines will be supplied and fitted by the builders, having cylinders 24 in., 40 in., and 64 in. diameter respectively, and a stroke of 42 in. As the vessel left the ways she was gracefully named *Border Knight* by Mrs. A. Scott, of Anan.

Thistle.—On June 23rd the London and Glasgow Engineering and Shipbuilding Co., Limited, launched the twin-screw gunboat *Thistle* for the British Government. This vessel is a sister ship to the *Dwarf*, which has lately been handed over to the Admiralty by the same builders after most satisfactorily completing all her trials. To hasten completion of the ship, the builders on this occasion have fitted the engines, boilers, funnel, masts, &c., on board before launching, the vessel being now practically ready for leaving for a Government dockyard. The Rev Dr. Niven, of Pollockshields, conducted the usual religious service; and the naming ceremony was performed by Mrs. J. D. Milton, Partick.

LAUNCH.—IRISH.

Star of Australia.—On June 24th there was launched from the north yard of Messrs. Workman, Clark & Co., Limited, a large steel screw-steamer built to the order of Messrs. J. P. Corry & Co., London. The christening ceremony was gracefully performed by Miss Ella Corry, second daughter of Mr. John Corry, J.P., London, managing owner of the company, who named the vessel the *Star of Australia*. This is the fifth boat built for Messrs. J. P. Corry & Co. by the builders, and judging from her present appearance there is no doubt she will fully sustain their well-known reputation as designers of large cargo boats. The leading dimensions are:—Length, 440 ft., breadth, moulded, 55 ft.; depth, moulded, 33 ft., with a gross tonnage of 7,370 tons. She has been built under special survey to class 100 A1 at Lloyd's, and to the Board of Trade requirements for a first-class cargo steamer. There are five cargo holds, and, as this vessel is chiefly intended for the Australian and New Zealand trade, three of these are insulated for carrying frozen meat, the system of refrigeration being conducted on the most approved principle. Water ballast is carried in the double bottom extending the entire length of holds and machinery spaces, the after-peak is also arranged as a water ballast tank for trimming purposes. Accommodation is provided amidships on the shelter deck for the captain, officers, and engineers, and the crew is comfortably berthed forward under the shelter deck. The *Star of Australia* will be rigged as a brigantine, the lower masts and yard being of steel. The deck machinery and gear is all arranged for the quickest handling of the vessel, and fast discharge of cargo, and embraces ten powerful steam winches, steam and screw steering gears and patent windlass by the best makers. After the launch the *Star of Australia* was towed to the 100-ton crane to receive her spars and machinery. The machinery has been constructed at Messrs. Workman Clark & Co.'s engine works, and consists of triple-expansion engines supplied with steam from four large steel boilers. Among others the following company assembled to witness the launch, Lord Charles Kennedy, Mr. John Corry and Miss Corry, London, Mr. and Mrs. Robert Corry and family, Mr. and Mrs. Robert Clark, of London, Mr. and Mrs. Gotto and family, Miss Pinkerton, Mr. John Workman, Captain John Simpson, and Mr. MacDonald.

TRIAL TRIPS.

Stentor.—On May 20th a fine steamer, the *Stentor*, left the Mersey for Glasgow, where she loads a portion of her outward cargo for China, and subsequently returns to Liverpool to complete loading. This steamer has been built to the order of Mr. Alfred Holt, by Messrs. Workman, Clark & Co., of Belfast, and has been engined in Liverpool by Messrs. David Rollo & Sons. Prior to her departure for Glasgow a small party proceeded to inspect the vessel, which was lying in the river off the Alexandra Dock. The *Stentor* has two masts, with fidded topmasts, and one funnel. Her principal dimensions are:—Length, 440 ft.; beam, 52½ ft.; and depth, 33½ feet, she carries 3,000 tons of water ballast, a portion of which is put into two deep tanks, each of about 900 tons capacity. One of these large tanks is placed forward of the engine space and the other aft. Her gross register tonnage is 6,700. In some respects she constitutes a new departure in shipbuilding, as in the main hatch pillars have been dispensed with, their duties being taken up by intercostal girder frames between the deck beams, with the hatch coamings forming part of same. This allows of a much larger hatchway, an important feature in vessels engaged in the China trade. The same system of construction is carried out in a modified degree in the remaining portion of the vessel. The sternpost of the vessel represents another novel feature in this class of single-screw steamer; in this case the deadwood is completely cut away, and the usual casting dispensed with, and in its place there has been substituted a wrought steel tube, which forms the after post, and upon which the rudder is hung by one pintle, instead of six as by the ordinary arrangement. The remainder of the stern frame consists of an arched mild steel plate of a U section, to the lower forward end of which is attached a steel casting, forming the post for the rudder. The rudder is of the balanced type, and has been designed so that its displacement is equal to its own weight. Special attention has been paid to the vessel's steering apparatus The cargo outfit is of the most ample description, one of the numerous heavy derricks which have been provided being capable of lifting 35 tons, and she has no fewer than 17 winches. To further facilitate the rapid loading and discharging of cargo she has a complete electric light installation. The machinery consists of a set of triple-expansion engines, having cylinders of 29 in., 50 in., and 82 in., by 60 in. stroke of piston; steam is supplied by two boilers working at a pressure of 180 lbs. per square inch; the main boilers are fitted with 12 Morrison flues, 43 in. internal diameter; they have 9,400 ft. of heating surface and 450 square feet of grate surface, and are fitted with forced draught, the fan being 8 ft. in diameter. The engine-room also contains a number of auxiliary engines, such as circulating pumps, fresh water condenser, feed pumps, &c. A large donkey boiler for the supplying of steam to the deck machinery is placed on the main deck. The engines are fitted with Aspinall's patent governor to prevent racing. At the preliminary run the engines worked with great smoothness, everything giving great satisfaction. The speed realised was 13½ knots, the revolutions being 80.

Kathleen.—On May 25th the steam trawler *Kathleen*, the pioneer ship of the Central Steamship Trawling Co., of Grimsby, went upon her trial trip. This was not only the initial trial trip of a new trawling company, but it was the inauguration of a new era in the fortunes of the town of Selby, for the *Kathleen* was the first product of the Selby Shipbuilding and Engineering Works. Although the ship and the company which own her are registered at Grimsby, she and the five other vessels of the same class which are in course of construction are really the outcome of Selby capital and public spirit. A large company, chiefly consisting of Selby gentlemen, left Hull in the *Kathleen*, and a pleasant voyage was made round the Spurn Lightship, and for several miles along the Yorkshire coast. During the speed trials the vessel ran over 11 knots per hour, and throughout the engines, which were constructed by Messrs. Crabtree & Co., of Yarmouth, gave every satisfaction.

Flora.—On May 27th this steel cargo steamer, built by the Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, went on her trial trip. Constructed to the order of Mr. D. W. Ellerhusen, Bergen, and to Norwegian Veritas highest class, the vessel is of the following dimensions:—Length, extreme, 235 ft.; breadth, 32 ft.; depth, moulded; 15 ft. 8 in. She is 1,032 brutto register tons. The engines are of the triple-expansion type, about 580 I.H.P. and the average speed 10 knots. The ship has a steel deck, double bottom for ballast, peak tank abaft, and is specially built for the timber trade. She is well fitted out in every way, having Emerson Walker & Co.'s patent steam anchor windlass, Fisher's patent steam-steering apparatus, three steam winches, and large donkey boiler. The main stop valve on the boiler is provided with Bower's patent rapid-closing apparatus from bridge, as well as engine room, and answered most excellently during the trial. The vessel and her machinery have been built under the superintendence of Mr. F. Hansen, Bergen. There were present on her trial trip the managing owner, Mr. D. W. Ellerhusen; inspector for Norwegian Veritas, Mr. Sejersted, and a large company of ladies and gentlemen. The trial was in every way a complete success, and the weather everything that could be desired, there being a light warm breeze from the north-west; the sun shining brightly, and reflecting the surrounding mountains very finely in the clear deep waters of the Fjord.

Paris.—On May 27th the trial trip of the s.s. *Paris*, recently built for Messrs. J. & P. Hutchison, Glasgow, by the Irvine Shipbuilding and Engineering Co., Limited, Irvine, took place. A large company of ladies and gentlemen were on board, and the vessel after adjusting compasses ran the measured mile with satisfactory results, a speed of fully 10½ knots, with about 300 tons cargo on board, being obtained. The vessel is 180 ft. by 27 ft. 6 in. by 14 ft. moulded, and has a long poop, bridge, and topgallant forecastle, and cellular double bottom and fore-and-aft peak tanks for water ballast. The net register tonnage is 123 tons, and deadweight 750 tons. The vessel has been built to Lloyd's highest class under special survey, and has been specially designed to meet the requirements of the owner's Continental trade, being similar in design to the s.s. *Hector*, built by the same firm last year for Messrs. Hutchison. The machinery has been supplied by Messrs. Hutson & Son, Limited, Kelvinhaugh, Glasgow, the engines being triple-expansion, having cylinders 14 in., 23 in., and 37 in. by 27 in. stroke, steam being supplied from a steel boiler 10 ft. diameter by 13 ft. 6 in. long, and 160 lbs. working pressure. The owners expressed themselves highly satisfied with the vessel and machinery.

Scandinavia.—On May 27th, the trial trip of this vessel, which has just been completed by Messrs. Carmichael Maclean & Co., shipbuilders, Greenock, took place. The dimensions of the vessel are:—239 ft. 4 in. by 35 ft. by 17 ft. 9 in., moulded, and the gross tonnage is 1,557 tons. The engines are by Messrs. Muir & Houston, with cylinders 19 in., 31 in., and 51 in., and 36 in. stroke, two large boilers and donkey boiler, &c. The vessel is fitted with steam-steering gear, steam windlass, four steam winches, two steam cranes, and with all the latest improvements to Lloyd's class. The *Scandinavia* had 1,773 tons deadweight on board, and the speed attained was fully 10 knots. The vessel has been designed and constructed for the Svenska Lloyd's.

Brisgavia.—On May 31st, previous to departing on her maiden voyage to Baltimore, the above steel screw-steamer proceeded down Belfast Lough on her trial trip; a company, comprising the owners' representatives, the builders, and their friends being on board. The *Brisgavia* has been built and engined by Messrs. Workman, Clark & Co., Limited, of Belfast, and is specially designed for a large carrying capacity, with the most efficient means for rapid discharge of cargo; she is owned by the Hamburg America Line, and during construction was under the direct superintendence of Mr. E. Blumenthal, Mr. Carl van der Smissen, and Mr. W. Brandt. The principal dimensions are:—Length, 450 ft.; breadth, 53 ft.; depth, moulded, 34 ft. 7 in., with a gross tonnage of 6,575. The *Brisgavia* is classed 100 A1 at Lloyd's with special survey mark in the Register, and has all of the Board of Trade requirements for a first-class cargo steamer. She has been subdivided into seven watertight compartments, and carries water ballast in forward and after peaks and right fore and aft in the cellular double bottom. There is also for trimming purposes a deep tank of 560 tons capacity, which may also be used for carrying cargo. On the deck of a long cargo bridge ample accommodation is provided for the officers and engineers; the saloon is tastefully panelled and upholstered, and electric light has been fitted throughout by the Globe Electrical Co. The crew is berthed forward under the forecastle, the space below the poop deck, like that of the bridge, being utilised for cargo. The engines are a powerful set of the triple-expansion type, with all of the most recent improvements. Steam is supplied at a pressure of 165 lbs. from three large steel boilers. Like the hull, the machinery has been inspected during construction by Lloyd's surveyors and finished to their satisfaction. The trial trip was most successful in every respect, and after lunch several toasts were proposed, among which was "Success to the *Brisgavia*," which was proposed by Mr. Workman, coupled with the health of Mr. Blumenthal, representative of the Hamburg America Co., who, in responding, expressed himself as being highly satisfied with the ship and machinery, and hoped this would not be the last ship built by Messrs. Workman, Clark & Co., for the Hamburg America Line. He then proposed the health of the builders, coupled with the name of Mr. Charles E. Allan, the engineering partner of the builders' firm, who suitably responded. This toast was also acknowledged by Mr. R. W. Leyland, of Liverpool, who said that the *Brisgavia* had been originally intended for his firm, but that the contract had been transferred to the Hamburg America Co. He had every confidence in the future of the new steamer as she had been designed with great care and furnished with every modern appliance for working cargo. The last steamer built for his firm by Messrs. Workman, Clark & Co. had been most successful, and he hoped soon to place an order with them for another steamer. Other toasts followed, and the company afterwards separated and later in the day left the steamer by tender, the *Brisgavia* proceeding on her voyage to Baltimore.

Saxonia.—On Saturday, June 3rd, the large new screw-steamer *Saxonia* proceeded to sea for her official trial trip. She is built by the Flensburg Shipbuilding Co., for the Hamburg America Line for their trade between Hamburg and East India. This vessel is 400 ft. in length, by 46 ft. 3 in. beam, by 30 ft. 2½ in. depth, moulded, with long poop and forecastle, built to German Lloyd's class, and is rigged as a two-masted schooner and having accommodation for officers in a large deckhouse on top of bridge amidships and crew in forecastle. She is lighted throughout by the electric light, including cargo lamps, bunker lamps, hand lamps, Suez projector, &c. A double bottom is fitted on the cellular system all fore and aft, and the hull is subdivided by a large number of watertight bulkheads. She is handsomely and comfortably fitted and ventilated throughout in a manner suitable for service in warm climates. The vessel is fitted with steam windlass, ten steam winches, two steam capstans, steam-steering gear, large derrick posts and 15 derricks for 5-20 tons. The engines, which have also been constructed by the Flensburg Shipbuilding Co., are of the triple-expansion type with cylinders 26½ in., 44 in., and 72 in. by 48 in. stroke and two double-ended boilers. During the trial the engines worked in a highly satisfactory manner at 75 revolutions per minute, and a mean speed of 12 knots was attained on the measured mile.

Tullochmoor.—On June 3rd the trial trip of the steamer *Tullochmoor* took place. This vessel is the latest addition to the Moor Line, Limited, managed by Messrs. Walter Runciman & Co., Newcastle-on-Tyne (of which we gave particulars in our Launch columns, June issue, page 133). During the trial the performance of the machinery gave every satisfaction. On the measured mile a speed of 11½ knots was easily obtained without pressing the machinery. After the trial the *Tullochmoor* proceeded in ballast to North America, in command of Captain Moffett, of South Shields.

Una and **Gipsy.**—On June 3rd the speed trials of the steam yachts *Una* and *Gipsy* were run. The former has been specially built by Mr. Claud Macdonald for Mr. R. S. Gilmour, yacht agent, Greenock; the latter was built by Mr. J. A. M'Kie three years ago for his own use; and both vessels have been fitted with duplicate machinery and boilers by Messrs. M'Kie & Baxter, Copland Works, Govan. The engines are of a new type introduced by this firm for small yachts. The yachts themselves each measure 50 tons, and are of similar dimensions. They left Gourock Bay at midday for the Admiralty-checked knot on the Gareloch, and ran the distances in company with practically the same mean speed—11½ miles. The engines are C.S.C., 7 in. by 14 in. by 9 in.; boilers, 6 ft. diameter by 6 ft. long, natural draught, working pressure 125 lbs. Throughout the whole day the machinery worked without the slightest hitch, and to the entire satisfaction of the owners and their representatives.

H.M.S. Upnor.—On June 6th H.M.S. *Upnor*, built by Messrs. J. M'Arthur & Co., and engined by Messrs. Bow, M'Lachlan and Co., Paisley (of which we gave particulars in our Launch columns, May issue, page 91), went down the Clyde to run her official trials which were in every respect up to requirements, and gave entire satisfaction to the Admiralty representatives. On the conclusion of these trials the *Upnor* sailed for Sheerness. The Admiralty were represented at the trial by Mr. S. Rawlings, R.N.; Mr. J. Smith and Mr. Jago, Admiralty overseers; Mr. O. S. Summers, and Captain Hitches.

Mont Blanc.—On Tuesday, June 6th, the fine steel screw-steamer *Mont Blanc*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyard, Middlesbro', to the order of the Societe Generale de Transports Maritimes a Vapeur, of Marseilles (of which we gave full particulars in our Launch columns, May issue, page 88), was taken out to sea under the command of Captain Crouzat for her official trials. The vessel has been built under the supervision of M. Terras, naval architect to the company, with Captain Crouzat and M. Balansard as resident ship and engineers' inspectors. Mr. Goodwin, of Liverpool has also superintended on behalf of the owners. A large company were on board during the trials, including M. Lechamp, director of Transports Marine, M. Terras, Mr. E. A. Cohan, Mr. Ward, of Messrs. Elder, Dempster & Co., and Mr. Hall, of the Royal Mail Steam Packet Co.

Ras Mora.—On June 7th the fine steel screw steamer *Ras Mora*, built by Messrs. Wm. Gray & Co. Limited, West Hartlepool, was taken to sea for her official trip. Her owners are Messrs. Grahams & Co., of London, for whom Mr. M. Havelock, of Newcastle-on-Tyne, has acted as superintending engineer. The vessel has been built to Lloyd's highest class, and is of the following dimensions:—Length, over all, 341 ft.; breadth, 47 ft.; depth, 27 ft. 4 in.; with long bridge, poop, and topgallant forecastle. Triple-expansion engines have been supplied by the Central Marine Engine Works of Wm. Gray & Co., Limited, having cylinders 25 in., 40 in., and 65 in., diameter, with a piston stroke of 42 in., and two large steel boilers adapted for a working pressure of 160 lbs. per square inch. The trial was in every way satisfactory, a speed of 11½ knots being averaged, in ballast trim.

Weissenfels.—On June 7th the s.s. *Weissenfels*, which has been built by Messrs. Wigham, Richardson & Co., at their Neptune Shipyard, Newcastle-on-Tyne, to the order of the Deutsche Dampfschifffahrts Gesellschaft "Hansa," of Bremen, went for a very successful trial trip off the Tyne. The steamer is 370 ft. in length by 46 ft. beam and has been built to attain the highest class in Lloyd's Register. She is fitted with quadruple-expansion engines balanced on the Yarrow, Schlick & Tweedy system, which, together with her boilers, have been constructed by Messrs. Wigham, Richardson & Co. This steamer is the eighth vessel built by these builders for the "Hansa" Co., and there are more in course of construction by them. On the trial trip the machinery worked without the slightest hitch, giving satisfaction to all concerned, and driving the vessel at a speed of 12½ knots per hour. The owners were represented by Mr. D. Wulff, their superintendent engineer.

Lakonia.—On June 13th the screw-steamer *Lakonia*, built by the London and Glasgow Engineering and Shipbuilding Co., Govan, for Messrs. Donaldson Bros., Canadian cargo and cattle trade (of which we gave full particulars in our Launch columns, June issue, page 136), went down the Clyde on her trial trip. A large company of ladies and gentlemen were on board. The vessel attained a speed of 13 knots per hour, half a knot over that stipulated for in the contract.

Crewe.—On June 15th the steel screw steamer *Crewe*, built to the order of Messrs. Dent & Co., Newcastle, by Messrs. Wood, Skinner & Co., Limited, Bill Quay-on-Tyne (of which we gave full particulars in our Launch columns, June issue, page 133), proceeded from the Tyne for her official trial. The vessel ran the distance from Tynemouth to Newbiggen and back at the rate of 11 knots per hour, which was considered exceedingly satisfactory, the engines working at full speed all the time without a hitch of any kind.

Oriflamme.—On June 15th this vessel, which has been built by Messrs. Armstrong, Whitworth & Co., Limited, to the order of Messrs. Lane & Macandrew, of London, on behalf of Messrs. Desmerais Frères, of Paris, under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool (of which we gave full particulars in our launch columns, June issue, page 133), was taken for trial at sea, when a speed of over 11 knots was obtained. The auxiliary machinery was tried, and after several hours' run the vessel proceeded on her maiden voyage.

Manchester Port.—On June 17th the fine steamship *Manchester Port*, which has been built by the Palmers' Shipbuilding and Iron Co., Limited, Jarrow-on-Tyne, for the Manchester Liners, Limited (of which we gave full particulars in our Launch columns, June issue, page 133), was taken on her official trial trip, and was afterwards delivered to her owners. The *Manchester Port* is the first of two sister ships ordered from the Palmers' Company, the other being the *Manchester Merchant*, which, it is expected, will be put into the water early in the autumn. She has a deadweight cargo capacity of 8,600 tons, and powerful triple-expansion engines with an I.H.P. of 3,500, which on the measured mile gave her a maximum speed of 14 knots, and a mean speed over a series of runs of over 13½ knots.

Otta.—On June 17th the screw-steamer *Otta*, built by Messrs. John Priestman & Co. (of which we gave full particulars in our Launch columns, June issue, page 136), left the Wear for her official trial. Throughout the trial, which was in every way a success, the engines worked with perfect smoothness, and a mean speed of 11 knots was easily maintained, this being considered highly satisfactory.

Cork.—On June 17th the steel screw-steamer *Cork*, built and engined by Messrs. Blackwood & Gordon, Port-Glasgow, for the City of Dublin Steam Packet Co.'s Channel service between Dublin and Liverpool (of which we gave full particulars in our Launch colums, May issue, page 92), went down the Firth on her official trial trip. The company on board, who joined the steamer at Gourock, included—Sir William Watson, managing director, City of Dublin Steam Packet Co.; Mr. E. G. Ferber, superintendent engineer of the company; Mrs. Ferber, and Master Ferber; Mr. D. P. M'Geoch, senior partner of Messrs. Blackwood & Gordon; Mrs. M'Geoch, Mr. F. R. Purvis, partner; Mr. John H. Macalpine, partner; Mrs. Macalpine, Dr. Callaghan, secretary, City of Dublin Steam Packet Co.; Mr. George Gow, New Zealand; Mr. A. Forsyth, secretary and manager Dublin and Glasgow Steam Packet Co.; Mr. John Lyall, superintendent engineer of Clan Line; Mr. Bevis and Mr. Taylor, Liverpool. After cruising about the entrance to Loch Long, Holy Loch and the Firth, the steamer, which was loaded with a deadweight cargo of 620 tons, proceeded to make a succession of four runs between the Cloch and Cumbrae Lights, when a mean speed of about 15 knots was attained, which is in excess of requirements. After lunch, which was served in the spacious saloon on the final run, Mr. D. P. M'Geoch presiding. After the toast of "The Queen" had been heartily pledged, the chairman gave that of the company and her owners, coupling it with the name of Sir William Watson, whose health he also proposed. In doing so he remarked that the *Cork* was the sixth vessel built by his firm for the City of Dublin Steam Packet Co. The trade *between Dublin and Liverpool* since they first did business with the company had increased very much, and was still increasing, and he hoped the day was not very far distant when the seventh vessel would be laid down in the Castle Yard, Port-Glasgow. The City of Dublin Steam Packet Co. was represented there that day by Sir William Watson. They were glad to hear of the honour lately conferred upon him, and they congratulated him upon the position which he now occupied. Sir William took a great interest in all the vessels of the company, and he thought they might predict an era of prosperity for the City of Dublin Steam Packet Co. In responding to the toast, Sir William Watson remarked that the *Cork* was very much similar in respect of fittings to the other vessels built by Messrs. Blackwood & Gordon for his company, but increased passenger accommodation had been provided. They had great reason to be pleased with the way in which Messrs. Blackwood & Gordon had fulfilled their contracts, and from what he had seen that day of the *Cork* he was quite satisfied that her speed would surpass that of her predecessors. Sir William then proposed the toast of "The Builders," remarking that they had spared neither time nor energy in producing the ship which they were asked to produce, and he confidently said that they had done so. Mr. Purvis responded. "The Officials of the Company" was afterwards submitted by Mr. Macalpine, and replied to by Dr. Callaghan. The latter thereafter proposed the toast of "The Ladies," to which Mr. Wedgwood responded. ~~After landing the guests at Gourock~~, the *Cork* proceeded to Liverpool under the command of Captain Memry.

West Point.—On June 17th the large new steamer *West Point*, built for the Norfolk and North American Steam Shipping Co., Limited, by Messrs. Robert Stephenson & Co., Limited, left Hebburn for her official trial at sea. The vessel is a heavy one for general provision cargoes, and will trade between London and Philadelphia regularly with the other "Point" liners of the firm, for whom Messrs. Simpson, Spence & Young, of Guildhall Chambers, Newcastle, are the managers. The *West Point* is an excellent type of cargo carrier, and has a very smart appearance. Her dimensions are:—Length between perpendiculars, 375 ft.; beam, 50 ft.; and depth from top of steel shelter deck, 38 ft. Her carrying capacity is 7,500 tons. There is good accommodation for the crew and cattlemen in the forecastle, representing over 60 hands when 30 or more cattle attendants are voyaging with beasts. There is a long shelter deck amidships, with steel deck, and on the top of this in a spacious deck-house is excellent accommodation for the commander, officers, and engineering staff. Beneath the shelter deck is accommodation for a large number of cattle. The West Point is classed 100 A1 at Lloyd's on the three-deck principle. She has two complete steel decks in addition to the steel shelter deck already mentioned. She has also a double cellular bottom fore and aft for water ballast, and in addition a deep ballast tank of 1,000 tons capacity. The deck fittings for working the cargo are extensive, and the principal hatches lie athwartship more than fore and aft, to enable loading on one side of the vessel whilst discharging is going on at the other side, if necessary. She has nine steam winches, steam steering gear by Messrs. Donkin & Co., and steam capstans by Messrs. Emerson, Walker & Co., and to work these is a large donkey boiler of the marine type. To support the principal cargo-lifting gear there has been fitted six ventilating derrick posts, in addition to the mast derricks. The vessel is rigged as a schooner, and has telescopic top-masts to enable her to pass river bridges. Her engines, which have also been built by Messrs. Robert Stephenson & Co., Limited, are triple-expansion, with cylinders 26 in., 43 in., and 71 in., and 48 in. stroke, and all take steam from two large single ended boilers of 1,000 H.P. each. The working pressure is 180 lbs., and the boilers are fitted with Howden's patent forced draught. The engines are 400 H.P. or 2,000 I.H.P. The trial was in every way satisfactory, and speeds, not only on the measured mile, but also on long point to point runs, were obtained equal to 11¾ to 12 knots. The *West Point* is the first of two vessels of the same class which the builders have in hand for the owners. The vessel is commanded by Captain David Jenkins, an experienced Atlantic navigator.

Gothland.—On June 20th the steamer *Gothland*, of the Liverpool and Hamburg Co.'s service (Messrs. Donald Currie & Co.), is an old and tried boat, which has been in the run between Liverpool and Hamburg for many years, and, though her passenger list is necessarily limited, those who have gone to the Continent in her have had every reason to be satisfied with their choice of a steamer, for whilst not excelling in point of speed, she has earned a reputation for being as comfortable a boat to travel in as any leaving the port. Her owners have, however, for some time thought that in point of speed an improvement might be made, and with this view placed her in the hands of Messrs. David Rollo & Sons, the well-known engineers and ship repairers, of Fulton Engine Works, Liverpool, to have her engines converted, and in order that such other work as was necessary should be carried out. In opening out the vessel to re-engine her, the Messrs. Rollo found that though she was 28 years old, her structure was almost as good as when she was first placed on the service. In the hands of these engineers then the *Gothland* has had her boilers and engines renewed, and advantage was also taken to bring her up to date. All worn or defective parts were removed and newly fitted. She was supplied with a completely new deck, while the winches and cargo gear were also up to as perfect a condition as possible, two new winches by Messrs. John H. Wilson & Co., Liverpool, being fitted. The new machinery is of the triple-expansion type, the cylinders being 20½in., 34 in., and 55 in., by 39 in. stroke, with a boiler pressure of 265 lbs. Steam is supplied from two large single-ended steel boilers, each 13 ft. 3 in. diameter by 9 ft. 8 in. long. The total heating surface is 3,100 square feet, the grate surface being 97 ft. There is also a large donkey boiler on deck for supplying steam to the deck machinery. On her trial trip the engines worked very smoothly, and gave every satisfaction to the owners' representative on board, developing about 1,000 H.P., with 66 revolutions per minute. The entire absence of vibration during the trip was commented upon. On the outward run between the Bar Lightship and the North - west Lightship, the vessel showed an average speed of 12¾ knots, and the speed as noted from time to time showed between 12 and 13 knots. It may be stated that the *Gothland* is the second vessel that Messrs. Rollo re-engined for the Castle line, and they have shown how such a vessel can be brought up to modern requirements. The result of the trial justifies the wisdom of the owners not only in planning the conversion, but also in their choice of a firm to carry out such work. The *Gothland* is a steamer of 1,482 tons gross, her dimensions being 252 ft. long, 32 ft. beam, and 16.9 depth of hold.

Ping Suey.—On June 20th the steel screw steamer *Ping Suey* proceeded down Belfast Lough on her trial trip. She has been built to the order of the China Mutual Steam Navigation Co., of London, by Messrs. Workman, Clark & Co., Limited, Belfast, and is the seventh vessel they have constructed for these owners. The *Ping Suey* has been designed for the Eastern trade, and built under Lloyd's special survey for the 100 A1 class; she is also provided with a Board of Trade passenger certificate. The dimensions are:—Length, 450 ft.; breadth, 53 ft.; depth, moulded, 34 ft.; with a gross tonnage of 6,457, and deadweight carrying capacity of 9,200 tons. The vessel is rigged as a two-masted schooner, the masts being telescopic, to suit the Manchester Ship Canal; she is sub-divided into eight water-tight compartments, and water ballast is carried throughout the entire length in a cellular double bottom, the peaks at extreme ends and a deep midship tank being also adapted for carrying water for trimming purposes. The saloon, captain's, officers', and engineers' state-rooms are on the bridge deck amidships, and the native crew are berthed aft under the poop deck, the spaces below bridge and forecastle decks being utilised for carrying cargo. The machinery, consisting of triple-expansion engines, two large steel boilers, and an auxiliary boiler, has been constructed at Workman, Clark & Co.'s Engine Works, and is fitted with the most modern improvements. On trials on the measured mile the speed of the *Ping Suey* proved highly satisfactory. A company of the owners and builders were on board, and during the day enjoyed the cruise in Belfast Lough, and at luncheon Mr. Gulland, managing director of the China Mutual Co., expressed himself well satisfied with the manner in which the steamer has been completed. The construction of the vessel has been under the supervision of Captain John S. Hogg, commodore of the China Mutual Co.'s fleet. After the trials the *Ping Suey* proceeded to Glasgow under the command of Captain de la Parelle, where she will load for her maiden voyage to China and Japan.

Upada.—Lately the steamer *Upada*, built to the order of the British India Steam Navigation Co. by Messrs. A. & J. Inglis, Glasgow, completed her trials on the Clyde. The *Upada* is of 5,600 tons gross register, and carries a deadweight cargo of 8,000 tons. She is intended chiefly for the company's trade from Calcutta to Mauritius, and in the season to Australia, being adapted for the conveyance of a large number of horses. Although denominated a cargo ship, she has a Board of Trade passenger certificate, and can be readily converted into a trooper or passenger steamer. The trial was in every way successful.

Arcadia.—Lately the new screw-steamer *Arcadia*, built and engined by Messrs. John Readhead & Sons, South Shields, had her official trial trip, and on a series of successful runs, averaged a speed of 11 knots.

Reviews.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 1899. London: Charles Griffin & Co.

We have received a copy of the sixteenth annual issue of this most useful work of reference. It treats of its subject most exhaustively. The societies are grouped for convenience under some fourteen heads, according to the subject matter with which they are associated. Information as to the names of their officers, the dates of their meetings, their publications, with the amount of their entrances and subscriptions, details of their work generally, the papers that have been read during the year just concluded, are all afforded, and so far as we have been able to check it, the matter set out is not only exhaustive but also singularly accurate and up to date. Though the system of grouping the various bodies by subjects would appear to render the information contained in the volume sufficiently easy of access, there is an additional means of getting at any required point in the excellent index which is appended to the book. It may be said that the volume is a complete abstract of the work of the scientific year, and as the series lengthens each issue acquires an additional value from its relation to those which have gone before. We find in the set a complete history of this part of the work of scientific elucidation and exposition which has been so characteristic of the closing years of the present century.

The Mechanical World Pocket Diary and Year-Book for 1899.

Pressure on our space has prevented us from noticing earlier this amongst certain other annual publications of considerable value to the working engineer. We have on previous occasions noted the valuable features of this little work. The present issue again contains further additions to the information offered. The subject of oil engines is now somewhat exhaustively treated, and a number of tables dealing with the calculation of weights have been added. These are likely to prove of value to practical men. The little book now contains some 220 pages of well-printed matter. Yet it is still of a form convenient for carriage in the pocket.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from May 10th to June 7th, 1899.

9803 K. Bauer. Furnaces for steam boilers.
9846 A. Ritzos. Furnaces for steam boilers.
9855 H. R. Mortell. Spreaders for trawl nets.
9859 A. Graemiger. Screw propellers for vessels.
9866 W. F. Bladon. Dealing with exhaust steam.
9898 A. G. Mumford. Steam generators.
9931 W. H. Wise. Derrick swinging gear.
9948 J. Stumpf. Pump valves.
9975 G. G. M. Hardingham (E. Dolby and A. C. Anden, South African Republic). Water-tube boilers.
9988 G. A. Nussbaum. Steam boilers.
9989 H. A. Mavour. Governing of engines.
10003 J. C. Nichol. Boats.
10004 H. H. Lake (A. R. Shattuck, United States). Feed-water regulator.
10020 H. Parker. Dress for deep sea diving.
10033 M. J. A. Deydier. Stopping leaks in ships.
10050 T. C. Palmer. Steam generators.
10076 P. E. Hodgkin & W. May. Steam pump.
10101 A. Bruce. Valve mechanism for engines.
10114 F. Lobnitz. Preventing corrosion of shafts.
10117 C. P. Dean. Safety mooring shackle.

10143 J. C. E. Mathieu. Valve motion gear.
10145 J. C. E. Mathieu. Speed-changing gear.
10168 G. Ralston & H. Iles. Pendulum governor for marine engines.
10170 L. Brennan. Cylinders and pistons.
10171 G. Bestwick. Valves for steam, &c.
10172 J. I. Booker. Corrugated furnaces for marine boilers.
10173 S. E. Alley. Governing steam engines.
10191 W. Merritt. Launching lifeboats.
10202 A van der Woerd. Steam engine governors.
10213 J. H. Fullerton. Actuating the slide valves of steam engines.
10222 A. Gronholm. Pumps worked by steam.
10260 H. Hocking. Feed-water for steam generators.
10276 J. R. Rhodes. Divided dome for boilers.
10286 C. Vincent. Removing the scale from boiler tubes.
10296 S. Lount. Radial flow steam turbine engines.
10308 R. T. Preston. Valves for steam engines.
10346 Siemens Brothers & Co., Ltd. (Siemens & Halske) Aktien Gesellschaft, Germany). Packing pistons.
10380 J. D. Harrison. Speed indicating apparatus.
10421 W. H. Tate. Water gauges for steam boilers.
10436 J. I. Thornycroft. Water-tube boilers.
10441 M. von Schoultz. Searching for submerged objects.
10444 E. Edwards (F. Bender, Germany). Utilising the movement of waves.
10453 W. J. Pitt. Discharging cargoes for coaling on the high seas.
10469 J. Murrie. Steam condenser and vacuum pump.
10483 J. Donald. Gear for preventing vessels from foundering.
10522 C. F. D. Lang. Attaching keels to boats.
10533 The Leeds Forge Co., Ltd., & G. Cooper. Steam generators.
10543 N. McIntyre. Bars for boiler furnaces.
10578 P. R. J. Willis (T. Emerson, United States). Holding boats in position.
10602 G. Lawson. Rudders.
10624 R. G. Brooke. Water gauges.
10625 E. A. Vivinus & A. J. Hecht. Motor crank shafts.
10635 L. Marshall & S. Naylor. Steam boilers.
10649 F. J. Borland. Cooling engine cylinders.
10654 R. Fryer. Slide valve for steam engines.
10668 W. P. Thompson (J. P. Serve, France). Steering ships.
10687 C. F. G. Des Vignes & W. A. Cloud. Steam boilers.
10697 L. J. J. B. Le Rond. Rotary engines.
10712 W. Morris (D. Murray, South African Republic). Steam boilers.
10714 J. V. Scott. Ships.
10721 P. Bowie & W. Guilford. Preventing racing of marine engines.
10724 R. Meldrum. Supports for ships' boats.
10743 W. C. Morison. Checking the speed of a ship.
10746 D. Robertshaw. Improving the draught in boilers.
10747 J. W. McKinnon. Ships' davits.
10778 P. Meehan. Steam boilers.
10780 J. Craig, jun. Pressure reducing valves.
10788 G. Kingsley. Boilers.
10800 H. Lentz. Balanced double-beat valve.
10801 H. Lentz. Valve gear.
10818 S. L. Ravier & A. Janet. Closing the tubes of water-tube boilers.
10841 W. H. Wise. Derrick swinging gear.
10844 J. W. White. Alarm for ships' engine-room.
10852 W. E. Moss. Derrick gear for ships.
10856 A. E. Fairman. Bladders for use in ships.
10859 G. F. G. des Vignes & W. A. Cloud. Steam generators.
10881 J. W. Johnston (D. Little, Victoria). Steam turbines.
10887 R. C. Westphalen. Screw propeller for ships.
10921 H. V. Potter. Yacht pulley.
10926 R. F. Hall. Roller-bearing nest for shafts.
10972 H. H. Gardam. Reversing gear of steam engines.
10986 J. Y. Johnson. (J. S. Muckle, M. R. Muckle, jun., and T. C. Smith, United States.) Bulkhead doors.
10995 L. S. Bickley. Refloating sunken ships.
10999 W. H. Wise. Derrick swinging gear.
11009 J. D. Andrew. Automatic lubricators for crank pins.
11020 S. Lake. Surface and marine boats.
11032 G. W. Smorthwaite. Screw propellers.
11033 F. P. Price. Valve gear for steam engines.
11034 J. C. Schofield. Plugging devices for boats.

BOARD OF TRADE EXAMINATIONS.

Note.—1C denotes First Class; 2C Second Class.

May 27th, 1899.

Beal, Ralph	2C	S'nd'rl'nd
Byrtt, Wm.	2C	Liverpool
Campbell, Wm.	2C	London
Carr, George	2C	Hull
Charles, Alfred	2C	Aberdeen
Cromar, George	1C	,,
Crown, James	1C	S'nd'rl'nd
Dixon, Chas. H.	2C	London
Dixon, Paul	1C	N.Shields
Douglas, George	2C	Liverpool
Gibson, Thos. R.	2C	N. Shields
Handcock, H. C.	2C	London
Hunter, James	1C	Aberdeen
Jones, G. E.	1C	Liverpool
Livesley, A. E.	2C	,,
M'Gowan, J.	1C	,,
M'Leod, Alexr.	2C	London
Murdoch, A. R.	2C	Liverpool
Parry, Wm. J.	1C	,,
Pover, Saml.	2C	,,
Rankin, C. D.	2C	Aberdeen
Smith, E. R.	1C	N.Shields
Snowdon, Geo.	2C	S'nd'rl'nd
Swinton, David	1C	Aberdeen
Thomas, Ernest	1C	S'nd'rl'nd
Wilford, St'y M.	1C	,,

June 3rd.

Birch, Jacob	2C	Liverpool
Blue, Jas. L.	1C	Glasgow
Brown, Jas. D.	1C	Cardiff
Chivers, A. W. A.	1C	London
Conner, Robert	2C	Cardiff
Crockart, Andw.	1C	London
Currer, Robert	1C	Glasgow
Evans, Chas. J.	1C	London
Ferri, Geremias	2C	Liverpool
Fleming, W. G.	1C	Glasgow
Fridas, John	1C	Cardiff
Griffith, O. T.	2C	Liverpool
Houston, Robt.	1C	Glasgow
Irvine, S. F. D.	1C	,,
James, J.	1C	Cardiff
Jones, Ivor	2C	,,
Kean, Alexander	2C	Glasgow
Kennedy, R. D.	2C	,,
Lang, Wm.	2C	,,
Le Gall, W M'C	2C	London
Marnie, James	1C	Glasgow
Martin, Wm. G.	1C	,,
Matheson, Hugh	2C	,,
Montgomery, R.	1C	,,
Ramsay, John	2C	,,
Rattray, David	2C	,,
Revely, Percy G	1C	Cardiff
Scott, Alexr.	2C	Glasgow
Sproat, John B.	2C	,,
Vos, John B.	2C	Falmouth
Warren, James	2C	Cardiff
Williams, Owen	1C	Liverpool

June 10th.

Allan, John	2C	London
Butt, F. G. R.	1C	,,
Callan, H. F. P.	2C	Liverpool
Carstairs, G. L.	1C	London
Davidson, G. W.	1C	N.Shields
Deighton, J. E.	1C	Liverpool
Holman, W. H.	1C	London
Hornsby, Erst.	2C	N.Shields
Landrum, J. R.	1C	Liverpool
Lindsay, Js. B.	1C	London
Lishman, Jn. J.	2C	N. Shields
McArt, James	2C	Liverpool
McCulloch, P.	2C	London
Penny, Albert E	1C	,,
Rankin, Wm. W.	2C	Liverpool
Roberts, Hugh	2C	,,
Soldat, Sy'n'y G	1C	,,
Sutherland, J.	2C	,,
Tickle, John T.	1C	London
Tinn, James	1C	N.Shields

June 17th.

Barbour, John	1C	N.Shields
Blackburne, E.	2C	Liverpool
Bruun, N. C.	2C	N.Shields
Clark, Thomas	2C	,,
Colling, John	1C	,,
Dabell, A. F.	1C	London
Day, Anthony	2C	N. Shields
Duus, J. H.	1C	,,
Feely, Thos.	2C	Greenock
Imlach, Robert	1C	London
Jenkins, David	1C	Liverpool
Johnston, Wm.	2C	Greenock
Lumsden, T. H.	2C	Leith
Macleod, R. K.	2C	Greenock
M'Auslane, W.	2C	Liverpool
McFarlane, J.	2C	Greenock
Meikle, John D	1C	,,
Porteous, R. L.	2C	Leith
Smith, H. C.	2C	N.Shields
Speirs, John	2C	Greenock
Stewart, W. M.	1C	Leith
Watt, John	1C	,,
Whiteway, A. P.	1C	London
Woodhouse A. E.	1C	N.Shields

Messrs. Stern Brothers of 57, Gracechurch Street, London, have an exhibit at the Greater Britain Exhibition in the West Australian section, which will undoubtedly interest all those interested in lubricants. This exhibit comprises the various specialities which they manufacture such as their Sternoline Lubricant for Stauffer and Automatic Lubricators, Fram Lubricant for Motors, Sternoline Bricks for tunnel bearings of steamers, open bearings, and roll necks, high-class Dynamo and machinery oils, also specimen of their Paraffinum Liquidum B.P. 98, and Paraffinum Molle B.P. 98, the former being the most highly refined mineral oil in the market, being absolutely water-white, and entirely free of taste, smell, and impurities. They have four factories in which the manufacture of the above and other lubricants is carried on.

Dredger for Japan.—Messrs. W. Simons & Co., Limited, Renfrew, have received an order to construct a powerful Twin-Screw Hopper Dredger for Japan.

The Marine Engineer.

LONDON, AUGUST 1, 1899.

THE summer meeting of the Institution of Naval Architects, held at Newcastle-on-Tyne, has been replete with papers, communicated by the members, full of interest to engineers and members of the allied professions, and we only regret that our available space will not admit of dealing with them or reproducing all we would wish *in extenso.* Dr. Francis Elgar, vice-president of the institution, has dealt in a most instructive and interesting fashion with the distribution of pressure over the bottom of a ship in dry dock and over the dock blocks, basing his observations upon a serious accident to the North German Lloyd steamship *Fulda.* This is not the first accident of the kind, and, seeing the increasing size and weight per foot of length of steamers, the matter is of increasing importance to all concerned. Where the forward overhang of the vessel is great, as was the case in the *Fulda*, not only will a certain number of the forward blocks be entirely useless for support, but when the vessel lies in assumed equilibrium upon the remaining blocks, there will be no pressure upon blocks that are more than twice the distance abaft the centre of gravity of the vessel that the foremost block is before it. If it is assumed, as in the case of the *Fulda*, that the forward overhang is 5-16ths of the length, this would remove pressure from the after-blocks to the extent of 1-8th the length of the vessel from the after-block. This leaves only 9-16ths of the blocks distributed over the whole length of the vessel as contributing to carry the whole weight. The increase of pressure also upon the forward block by reason of a considerable overhang will be vastly increased as compared with the mean pressure calculated as if each block distributed over the whole length of the vessel bore its equal quota. With 5-16ths overhang the increase would be nearly four times the mean. These results, however, are upon the assumption that the wood-caps are only stressed within their elastic limit, so that each of the remaining blocks may properly come into bearing so as to carry their own proportion of weight. But when the caps of softwood and greenheart are of small depth, and the accumulation of pressure at the forward block is excessive, due to great overhang, the forward blocks may be all stressed beyond their elastic limit, and the maximum pressure on individual blocks may again be much increased beyond the stress above indicated, and it will be no matter for wonder that the blocks should be thus individually broken down in succession. It is obvious that the practice of fitting intermediate blocks where there is overhang is very effective in preventing the possibility of such accidents as that of the *Fulda* before the blocks under the rising keel can be made up, and it is recommended that the doubling and trebling of blocks near the commencement of the rise of the keel is most necessary to avoid liability to such accidents as that of the *Fulda.*

APPARENTLY the possibilities of forced draught have not yet been exhausted. Mr. Nelson Foley makes a suggestion, and gives details of a system of forced draught which is new as far as we are aware in its mode of application. He employs hollow fire-bars with a mushroom head protecting partially radial orifices, through which is injected the air blast which it is believed also induces an increased indraught from the external atmosphere between the bars. The bars are connected to an air chamber, or box, under the front of the furnace, or two of these air boxes may used as the front and back of the furnace. It has been found by careful experiment that combustion increases on this grate by increase of air pressure from 5·32nds of an inch to 3-16ths of an inch, and with the latter pressure the rate of combustion was 22·3 lbs. per square foot of grate area when stoked for maximum combustion. This result is so good that the arrangement appears to require serious attention. It offers the advantage that the stokehold is open and without encumbrance, and a good draught through it is induced by the forced air-jets. The bars during forced draught do not suffer at all, which might be expected, and clinker does not seem to adhere to the bars, but is readily removed. The bars were also run at natural draught to test their durability, and after 10 days' continuous run no more than normal injury was found to have been sustained, and only a few air holes were found to be choked. We think this system promises well.

MR. G. B. HUNTER's paper upon large Atlantic cargo steamers is extremely valuable as bringing up to date the unrivalled experience of his firm in the new conditions of construction of the present large Atlantic cargo steamers which have really only run since 1894. It is remarkable that until 1895 there were no more than four British cargo steamers of more than 6,500 tons gross register (always excepting the *Great Eastern*), whilst in March, 1899, no less than 54 cargo steamers of 6,000 tons gross register and upwards were building in British yards; and at present of merchant steamers of 10,000 tons gross register and over (cargo and passenger), there are 18 building in British yards (including the *Oceanic*, about 17,000 tons), nine in German shipyards, and two in French shipyards. The Atlantic leviathans have thus come to stay, and are apparently justifying their existence on economical and commercial grounds. Mr. Hunter gives what he considers the essentials for large cargo steamers for the Atlantic. There should not be more than three complete decks, including a shelter deck, with a partial fourth deck in the forehold only. With a complete shade deck there is no need for the further addition of a long bridge-house either for space or safety, and such further erections are undesirable, and should be limited to houses for the officers and steering and chart-house, with pilot bridge 15 ft. above it. Steel decks need not be sheathed with wood, nor should wood-sheathing be fitted on the double bottom. Very few Atlantic cargo steamers have sufficient water ballast, owing to the frequent necessity of making the outward passage in ballast. The 500 ft. 12,000 tons deadweight steamer should have not less than 4,000 to 4,500 tons of water ballast, of which 1,700 tons can be carried in the double bottom tanks, and 2,000 tons in two "deep tanks," one aft and one forward, and 800 tons in 'tween deck tanks. Large peak tanks in the extreme ends of the ships are undesirable as promoting pitching vibrations and uneasy motions. As to propelling machinery considerable power is required for the Atlantic in view of head winds and severe weather. A point of great difficulty is the question of the propeller shafting. It is recorded that 173 steamships were disabled in 1898—mostly in the Atlantic—by fracture of shafting. It is stated that 53 similar accidents occurred in April, May, and June this year. This can only be regarded as highly unsatisfactory. The causes are much debated. It is suggested that with new triple engines, there being less shock and danger to the engines when racing in ballast as compared with the old compound engines, captains and engineers are less careful as to reduction of speed, and are getting more accustomed to running under such conditions. The strain on the propeller shaft remains, however, the same as before, and if running in ballast and maintenance of speed is to be continued, Mr. Hunter recommends an increase of strength in propeller shafts 100 per cent. above present rules. He proposes also that all vessels of 10,000 to 12,000 tons should have duplicate engines and screws, giving smaller screws for running in ballast besides safety in case of breakdown of one; and this should be done in spite of other slight disadvantages appertaining to twin engines as compared with single engines. Mr. Hunter concludes with some valuable information as to the latest methods in his firm of building large steamships under glass shipsheds with travelling cranes running the whole length. He finds the result much more economical in building and in the saving of staging and long shores, as the columns supporting the roof are freely used as abutments for the shores.

Information obtained by direct experiment upon the frictional resistance of the ordinary collar-and-ring thrust-block, and the saving to be effected by the use of roller-bearings in such a block, has been communicated by Herr F. von Kodolitsch. He constructed a thrust-block suitable for an engine developing 600 I.H.P. at 136 revolutions per minute to travel a vessel at 12 knots per hour. From these data he deduced the necessary thrust upon the block under these conditions, and then weighted on a horizontal table the thrust-block placed vertically to correspond to these conditions. The thrust-block was then driven by an electrical motor up to the desired speed of 136 revolutions, and the H.P. developed by the motor for driving the weighted block measured its frictional resistance after due allowance for the efficiency of the motor and gear, which was also tested for each experiment. In this way the block, being adapted to drive one way on roller-bearings, and the other way on white-metal rings and collars, it was found that under these diverse conditions the block absorbed in friction 2·4 H.P. when running on the roller-bearings lying in a bath of lubricant, and 29·75 H.P. when running on the rings and collars in the ordinary way. This saving appears worth obtaining by the use of roller-bearings. Though the anti-frictional value of such bearings has long been known, the practical difficulty arises not in their application, but in their tendency to irregular wear, which Herr Kodolitsch did not touch upon.

The past month has been signalised also by the meeting at the Fishmongers' Hall of the International Maritime Conference, under the able presidency of Mr. Justice Phillimore, whose experience in the legal aspect of maritime disputes is so wide and general. By unanimous consent Dr. Sieveking was elected as vice-president during the unavoidable absences of the president, owing to his judicial pressure of business. The questions exhaustively discussed were the relative apportionment of damage between two vessels in collision where both were to blame. After settlement of the relative apportionment of damage the next question considered was, Should the principle of proportional apportionment of damages apply to the cargoes as well as to the ships, or should the cargo-owners and other third parties be entitled to proceed jointly and severally against the two vessels? After much general discussion, injury to life and limb was dissevered from the question of damage to cargo and property in the vessel, the former consideration being evidently a more thorny one than the latter. A further important discussion was upon the point whether the responsibility of shipowners be personal, and, if so, should it be limited, and how; or should it be confined to the ship and freight? Upon this point there seemed to be much diversity between the Continental and the British view of the advisability as to such limit, and a long and very full discussion ended in two resolutions: first, that the shipowner shall be permitted at his option to discharge his liability either (*a*) by abandoning ship and freight, or (*b*) by paying a sum of money calculated upon the tonnage. This resolution has no reference to claims for loss of life or personal injuries. The second resolution was a lament upon the diversity of national laws regarding collisions at sea, and an invitation to Her Majesty's and other Governments to institute a full inquiry into the whole subject.

At the moment of going to press we are shocked and startled by a terrible disaster befalling a destroyer, the *Bullfinch*, upon its full-speed trials in the Solent. It is believed that the breaking of a connecting-rod smashed a high-pressure cylinder or cover—with the instant release of vast volumes of boiling water and steam into the confined engine-room and stokehold. The results were most disastrous, causing immediately the death of eight men and serious injury to six others, some of whom will probably not survive. Nothing can be said at present as to the probable causes of this grave disaster, and we can but add our mite to the public sympathy for the lives cut short in so untimely a manner and for the sufferings of the injured. We have again to press emphatically upon the Admiralty that the use of self-closing steam-check valves in the steam-pipes close to the boilers, such as we discussed and illustrated in our issues of February and March, 1898, would have served to prevent the chief part of the fatalities resulting from this accident, however caused.

ON THE BOILER ARRANGEMENTS OF CERTAIN RECENT CRUISERS.*

By F. T. Marshall, Esq., Member.

During the past few months the company with which the writer is connected have completed the machinery of several vessels of the cruiser class, which differed so noticeably in the type of boiler fitted that he thinks some comparison of the systems used, and some description of the arrangements adopted, may prove of interest to the members of the institution.

The vessels referred to are H.M.S. *Andromeda*, built at H.M. Dockyard at Pembroke; H.R. Portuguese M.S. *Don Carlos I.*, built at Elswick; and H.I. Chinese M.S. *Fui Tien* and *Ha Chi*, sister vessels, also built by the Armstrong Co.

At the end of the paper a comparative table will be found, giving particulars of the power, heating surface, grate area, space occupied, and weight of the boiler arrangements of these vessels. Outline sketches of the boiler-rooms and of the boilers themselves are also given.

Owing to the courtesy of Sir John Durston, the writer has been able to add similar information regarding H.M.S. *Hermes*. This vessel is one of the latest second-class cruisers in Her Majesty's service, and in size more nearly resembles the *Don Carlos* and *Hai Tien* than the *Andromeda* does.

Particulars are also added of H.M.S. *Æolus* and *Pallas*, which are typical second and third-class cruisers with cylindrical boilers.

The boiler installation of the *Andromeda* is shown in Fig. 1, and consists of thirty Belleville boilers fitted with economisers. These boilers are arranged in four watertight compartments, there being a separate funnel to each group.

The stokeholds are fitted with the necessary arrangements for closing in, fans being supplied to work them under pressure, if necessary. Each boiler-room is also supplied with a furnace air-pumping engine to supply air in jets above the fire-grates and also in the combustion chamber under the economiser.

The arrangement of the boilers of the *Hermes* is shown in Fig. 2, and consists of 18 Belleville boilers with economisers. These are arranged in three watertight compartments, each group having its own funnel.

The boiler arrangement of the *Don Carlos I.*, shown in Fig 3, consists of twelve Yarrow type boilers arranged in two watertight compartments with two funnels. It is of interest as being the largest installation of small tube water-tube boilers which has yet been tried at sea, and it may here be mentioned that all the trials passed off without the slightest hitch and no difficulties were experienced.

The forced draught fittings are on the closed stokehold system, there being four fans to each boiler compartment. In addition to the air which passes through the automatic draught plates at the front of the grate, a further air supply is given to the sides and back of the grate, by means of automatic flaps fitted in a screen built closely round the boiler front and fitting to the floor, sides, and top of the stokeholds.

The boiler arrangement of the *Hai Tien* and *Hai Chi*, shown in Fig. 4, consists of four double-ended and four single-ended cylindrical boilers. These are placed in three watertight compartments, two double-ended boilers in the forward and aft compartments, and four single-ended boilers in the midship compartment. There are two funnels, two double-ended and two single-ended boilers being led into each.

The forced draught arrangements are on the closed stokehold system, with four fans to each compartment.

It will be seen that the boilers of these vessels furnish examples of three of the principal types of warship boilers, viz.: (1) the large tube water-tube type, represented by the Belleville boiler; (2) the small tube water-tube type, represented by the Yarrow boiler; (3) the cylindrical fire-tube boiler.

Detail Construction.

As to the detail construction of the types under consideration, that of the Belleville boiler has been already fully described in various papers read before the Institution. Fig. 5 shows the general design of the economiser type of this boiler as fitted on board the *Andromeda*. The tubes, which are of solid-drawn steel, galvanised externally, are 4½ in. diameter in the generator elements, and 2¾ in. diameter in the economiser elements, in the boilers of the *Andromeda*. In the *Hermes*, the boilers of which are shown in Fig. 6, the generator tubes are 4 in. diameter and the economiser tubes 2¾ in. diameter.

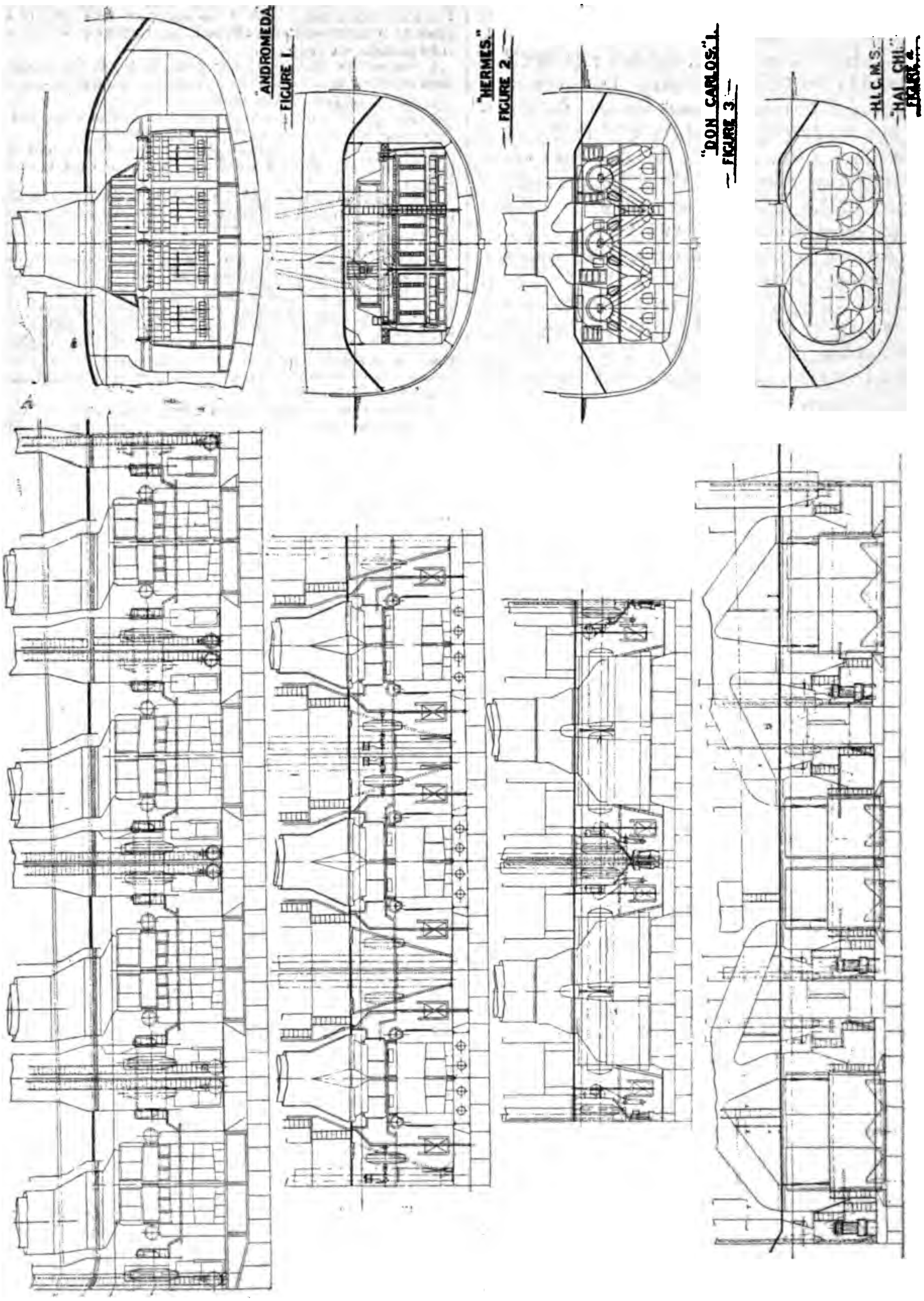
The Yarrow type boilers of the *Don Carlos* are shown in Fig. 7. As some departures have been made from the usual Yarrow type, some description of the construction and method of it may be of interest.

The method of manufacture is to completely rivet up the steam drum, the tube holes being previously all drilled through a cast-iron template. The wing pocket tube plates are also drilled to template and are then erected together with the steam drum on a triangular frame.

The boiler is then tubed in the ordinary way and the tubes expanded and bell-mouthed, after which the ends and bottom plates of the wing pockets are riveted in place. This completes the part of the boiler subjected to pressure. The tube ends are readily accessible in the finished boiler by means of ordinary manholes in the steam drum and water pockets. These manholes are flanged inwards and fitted with ordinary internal

---

* Read at the Summer Meeting of the Fortieth Session of the Institution of Naval Architects, July 19th, 1899, the Right Hon. the Earl of Hopetoun, G.C.M.G., in the chair.


"ANDROMEDA"
FIGURE 1
"HERMES."
FIGURE 2
"DON CARLOS" 1.
FIGURE 3
H.I.C.M.S.
"HAI CHI"
FIGURE 4

On the Boiler Arrangements of Certain Recent Cruisers.

THE NEW YO
PUBLIC LIBR
ASTOR, LENOX
TILDEN FOUND

doors. The tubes are of solid-drawn steel, the two rows next the fire being 1⅜ in. diameter, ·128 thick, and the rest 1⅛ in. diameter, ·104 thick. It will be noticed that all the tubes are straight, except the two rows next the fire, which are slightly curved. The reason for the adoption of this curvature is that these front rows of tubes, which are subject to higher temperatures and more sudden changes of temperature than the rest of the tube surface, have in some cases, when initially straight, shown a tendency to spring against each other in varying directions. This obstructs the uniform flow of the gases, besides being mechanically objectionable.

By slightly curving the outer rows as shown, any springing takes place in a known and definite direction, and does not, therefore, have the effect above indicated, whereas the curvature is so slight that it does not appreciably interfere with cleaning or inspection.

The boilers shown are fitted with straight external downcomer stay tubes, and, in addition to this, a certain number of tubes at each end of each pocket are baffled off from the fire to ensure them working as permanent downcomers, and, as far as possible, maintaining a uniform direction of circulation in the boilers.

The tubes are arranged in the tube plates with several gaps on the fire side. The object of this is to throw a greater number of tubes into actual contact with the fire, and thus somewhat relieve the outer rows, which are very severely worked. This arrangement also somewhat increases the combustion space.

There are no stay tubes actually distributed throughout the tube plates, these not being found necessary, besides being objectionable, owing to their greater thickness, and consequent different expansion to the adjacent tubes. That they are unnecessary is, the writer submits, shown by the following experiments made upon this point:—

A tube 1⅛ diameter, ·104 thick, standing ⅛ in. above tube plate, and merely expanded in, resisted a load of 4·6 tons before being drawn out. A similar tube, standing 1-16th in. above, required 4·22 tons, and a third just flush was drawn out by 3·3 tons load.

It will be seen that the strength of a large nest of these tubes is enormous, and is further increased by all the tubes being bell-mouthed inside. This latter operation also has the effect of improving the flow of water into the tubes, and thus assists circulation.

A matter of great importance in boilers of this type is the design of the casing work. These casings have to withstand not only high temperatures, but many sudden changes of temperature. They require to be stiff to maintain their form, but must be arranged to accommodate themselves readily to varying conditions of strain produced by heat, and, above all, they must remain airtight.

The form of casing shown in the photographs has been found to give no trouble whatever. It will be seen that this is arranged in panels, any one of which can be readily removed for examination or overhaul of the part of the boiler at which it is situate. The form of flange attachment adopted gives great freedom for expansion and contraction, besides stiffening the structure.

As to the cylindrical boilers, these are shown in Fig. 8, and are of the usual form and proportions adopted for vessels of similar type. There is a separate combustion chamber to each furnace. The tubes, which are of lapwelded steel, are 2½ in. diameter, and all fitted with the Admiralty cap ferrule in the combustion chamber end.

FEED ARRANGEMENTS.

This is always an important matter, but specially so in water-tube boilers holding comparatively small quantities of water, and it becomes most desirable that the feeding should be automatic.

The system adopted in the *Andromeda* is that generally used with Belleville boilers. Two large feed tanks, holding in all 13 tons of water, are placed high up in the engine-room. These large tanks are necessary, owing to the variable weight of water in these boilers when working at the different rates of evaporation due to sudden changes of speed of ship.

The feed-water is taken from the hot well by special pumps, and is pumped through the filters into the feed tanks. Thence it flows to the boiler feed-pumps, and is delivered into the boilers through Belleville feed regulators, which control the speed of the pumps by means of pressure produced by the inlet valves, which are actuated by a float arrangement.

In the case of the *Don Carlos* the feed-water is pumped by the air-pumps into two vertical feed-tanks, each holding 3¼ tons of water. Thence it flows by gravity through the feed filters to the feed-pumps in the stokeholds, of which there is one to each boiler.

The pumps are of duplex type, and are controlled by Mr. Yarrow's special arrangement, the steam supply to the pumps being taken from a guarded pipe just above the normal water level, so that, if the water is high in the boiler, it enters the pump cylinder, and so checks the speed of the pump.

The fitting is extremely simple, and worked admirably throughout the trials, and also when steaming at low speeds in the river, &c. It has, however, the objection of being somewhat wasteful, and is hardly so sensitive as the arrangements which check the feed supply direct.

The feed system used for the cylindrical boilers is for the air-pumps to deliver to a vertical tank in the engine-room, holding 4¾ tons of water. From this it flows by gravity to the boiler feed pumps, which are in the stokeholds, which deliver through the filters into the boilers, the feed regulation being by hand.

SPACE AND WEIGHT.

On looking at the floor area occupied by the three types of boilers, it will be seen the H.P. developed per square foot under natural draught is approximately the same. In other words, that for continuous steaming practically the same power may be obtained from the same size of boiler-room whichever of the three systems is adopted.

If, on the other hand, the maximum powers are considered, the advantage of both the Yarrow and the cylindrical type is very marked, as by the use of forced draught very much higher powers may be developed for short periods.

Again, looking at the heating surface contained in the various boilers per square foot of floor space, it will be seen that the Belleville and cylindrical types, which have about the same amount, have both substantially less than the Yarrow system. This seems to indicate that the loss of economy of the Yarrow type, when moderately forced, will not be very serious, whereas the cylindrical boilers can only be forced at a sacrifice in economy. This is borne out by experience, although at low powers the cylindrical type is more economical.

On comparing the grate area per square foot of floor space, the Belleville type possesses a substantial advantage. This is still more evident if comparison be made on the basis of 6 ft. 3 in. firebars, and there is an unquestionable loss of efficiency in stoking longer bars for long consecutive periods.

The large grate area on moderate length of bar obtained on a given floor space is one of the strong points of the Belleville type, and makes it an excellent boiler for maintaining high sea speeds for considerable lengths of time. This great gain is partly discounted by the loss of efficiency if the stoking is indifferent.

Owing to the tubes being so close down to the grates, the fires have to be kept very thin, but very uniform, to ensure good combustion. This trouble has been minimised by the introduction of a combustion chamber in the economiser variety of the Belleville type, but it is still a real one, and in evaporative trials a change of stokers may easily affect the evaporation per pound of coal to the extent of 10 per cent. This difficulty is noticeable also in the Yarrow type, but to a less degree, owing to there being much more space for combustion before the gases come in contact with the tube surface.

Next, dealing with the question of boiler-room weight, we find that, on the basis of the natural draught power, the two water-tube types are substantially lighter than the cylindrical type, the Yarrow type being the lightest.

On the basis of the maximum power the advantage of the Yarrow type in this respect is enormous, whereas the Belleville type is not materially lighter than the cylindrical, owing to the fact that it is not forced.

Thus, on a given weight, the Belleville type will develop, with natural draught, and for long periods, approximately the same power that the cylindrical type will develop for short periods of a few hours under extreme forced draught. Also, on the same weight, the Yarrow type will develop 14 per cent. more than the Belleville for long periods, and 78 per cent. more for short periods. Again, comparing the Yarrow with the cylindrical, it is seen that it will develop 50 per cent. more power for long periods, and 65 per cent. more for short periods, on a given weight.

The above comparisons are based upon total boiler-room weights, including water in boilers plus water in the feed and also such fittings as reducing valves, separators, &c., form an intrinsic part of the boiler systems.

separate weights of boilers and funnels, water, and boiler-accessories are also given, and it may be noticed how vely high the weight of accessories is in the case of the ville type, owing to the numerous special fittings which part of this system.

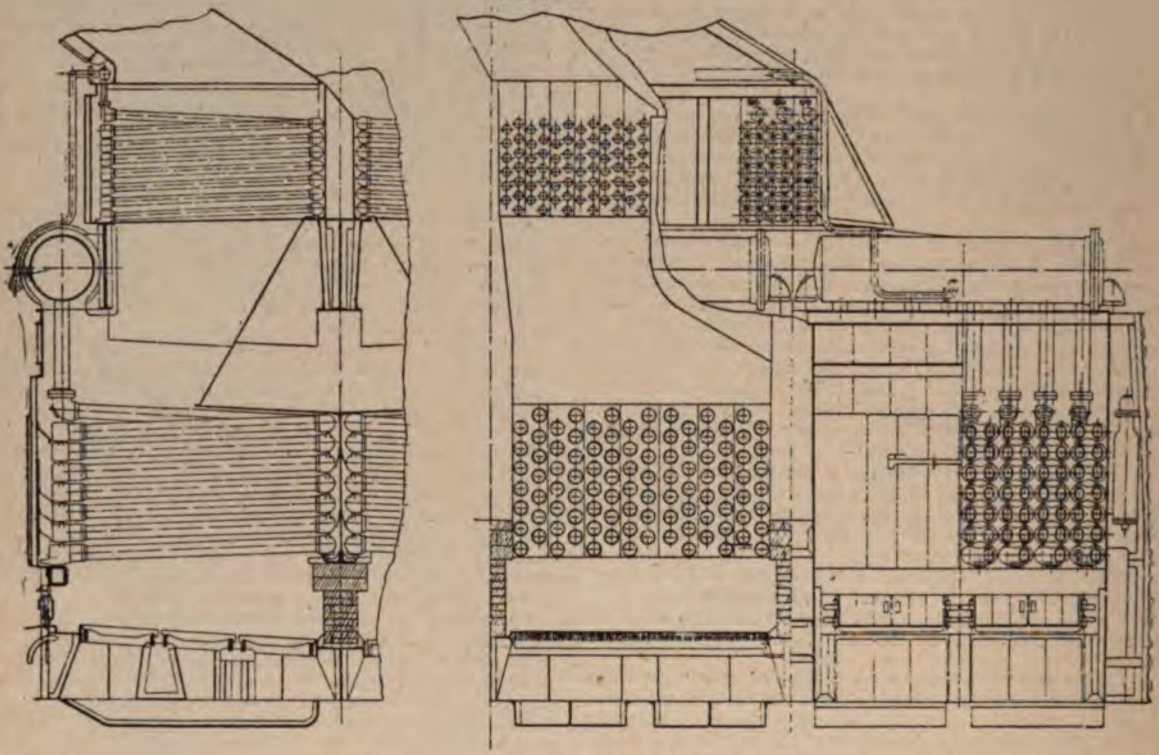
FORCED DRAUGHT.

A crucial point in the above comparisons of space occupied and weight is the question of how far forced draught can safely be used in the usual exigences of service, or even in the extreme case of war.

As to the Yarrow boiler, the writer submits that, as far as the boilers are concerned, this type may safely be forced to an

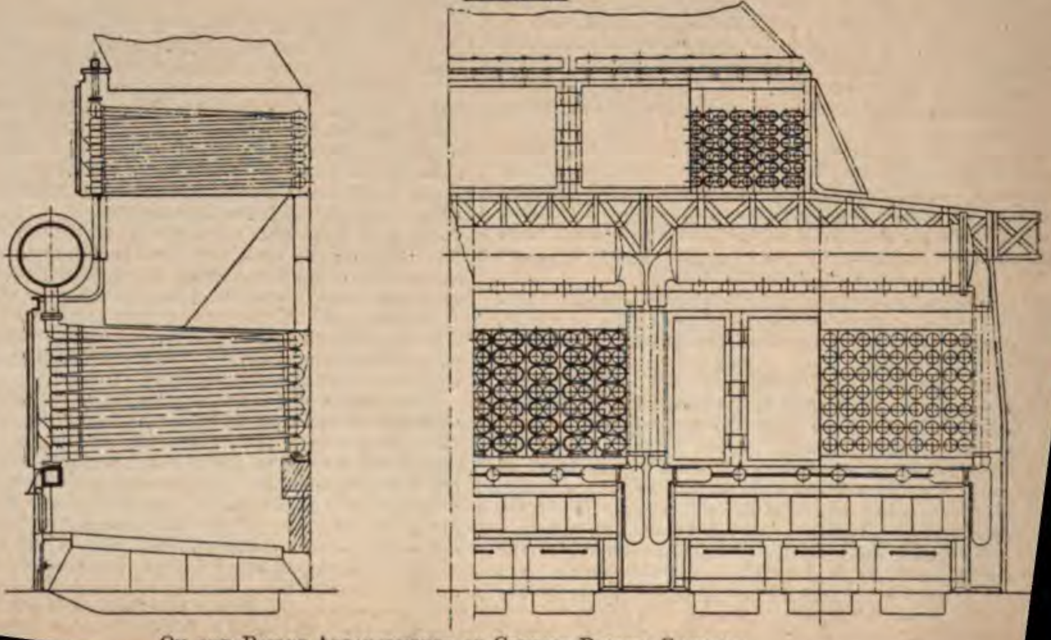
ANDROMEDA

FIGURE 5



HERMES.

FIGURE 6.



ON THE BOILER ARRANGEMENTS OF CERTAIN RECENT CRUISERS.

air pressure of, say, 2 in. (the maximum employed on the *Don Carlos* trials), as long as the coal lasts.

Working under these conditions is, however, very severe on the *personnel* of the stokeholds, and the endurance of the men would probably be found to be the measure of the time during which this power could be maintained.

In the case of the cylindrical boilers, a four hours' run is probably as long as these boilers could be worked at the maximum forced draught power.

These boilers have a tendency to suffer in the flame-box seams when long firebars are used, and it is only by the use of these long bars that the high powers looked for can be obtained. The tube ends also get choked up, especially if fitted with ferrules, and without ferrules the tubes have a great tendency to leak. It is probable that at the end of four hours the boiler efficiency would be seriously affected, and the power could no longer be maintained. On the other hand, however, the high speed obtained during these four hours might mean the salvation of the ship, and it is unfair to overlook this advantage.

It should be understood that the above remarks do not apply to forced draught applied to cylindrical boilers with moderate length of firebar, say 5 ft. 6 in., and with a heating surface of 2¼ ft. per I.H.P. Such boilers can be worked at about 17 I.H.P. per square foot of grate continuously at sea; but their size and weight would preclude their use in the type of vessel considered, as the power obtained would only correspond approximately to the results obtained in the ½ in. air-pressure trials of warships.

Raising Steam.

The rapidity with which steam can be raised, and the ready response to sudden demands in variation of power, are two matters of utmost importance in war vessels, and in both of these the water-tube types show a marked superiority over the cylindrical boiler. The large quantity of water contained in the latter makes it a question of hours to raise steam; and, if this operation is hurried, the boilers are strained to a serious extent, causing leakage. The same course of reasoning applies, though to a less degree, to any sudden and rapid large variation of power.

As to the two water-tube types, in both cases steam can be raised to full pressure in about 30 minutes from lighting fires. In the matter of variation of power there is also little to choose between them; for, although the large grate area of the Belleville type is an advantage, the safety with which the Yarrow type may be suddenly forced compensates for it.

Liability to Derangement in Working.

In this respect, apart from the difficulties mentioned under extreme forcing, the cylindrical type is to be preferred. All the arrangements, both of the boiler itself and of its accessories, such as the feed and steam pipe systems, are simpler than in the water-tube types. The boilers are fewer in number, thus reducing the number of pipes and connections, and the consequent liability to leaky joints, &c. The feeding is also less critical, owing to the large water level.

In addition to this, the introduction of salt water, even in considerable quantities, owing to leaky condensers or other causes, has little appreciable effect upon the working of the boilers.

Although, to obtain maximum results, these boilers must be in a state of thorough repair and cleanliness, they are still serviceable after considerable neglect such as would render any water-tube type quite useless.

With regard to the Belleville boiler, a grave objection, in the writer's opinion, is the enormous mass of mechanical detail in connection with it. Thousands of joints, all dependent upon extreme accuracy of workmanship, and many of them subject to extreme strain, due to varying temperature, are a pronounced feature in the design of this type

These points have been well met in the methods of manufacture, but most rigid supervision is required to maintain the accuracy necessary.

The feeding is also extremely delicate, owing to the small quantity of water contained, and the variable weight of this water at different rates of evaporation. This latter condition necessitates the introduction of the hot-well pumps and large feed tanks already described. The feed regulator employed, which certainly works admirably, is nevertheless a delicate mechanism, and has to be kept in a high state of efficiency. The number of boilers is also great for the power developed. This large subdivision has the advantage of involving only a small reduction of power, should one boiler become inoperative for any reason; but it certainly causes an enormous addition of important detail, such as feed-pipe and steam-pipe arrangements, all requiring care and attention. The furnace air pumping engines are also an additional complication, involving many extra fittings.

Whether these objections are valid extended experience alone can show, and it is an unquestionable fact that the vessels fitted with these boilers, especially since the addition of economisers, have passed through most severe trials with consistent success.

Referring to the Yarrow type, the construction in this case is extremely simple. None of the riveted seams are in direct contact with the fire, and the strains due to changes of temperature are not severe on the parts of the boiler under pressure, especially if the outer rows of tubes are curved.

The casings are probably the most severely tried part of the boilers, but no trouble need be feared from these, if carefully designed.

The great question about this and other small-tube types is the life of the tubes, owing to their comparative thinness. Any information which any gentlemen could give us on this point would be of extreme interest.

The tubes of the *Don Carlos*, as before stated, are ·128 and ·104 in thickness for the 1⅜ in. and 1⅛ in. tubes respectively. They are galvanised externally only, as is usual for this class of boiler in H.M. Navy. Mr. Yarrow, on the other hand, invariably galvanises the tubes both internally and externally, but this does not appear to be necessary in the case of a boiler with drowned tubes. It is probable that one cause of wastage on the outside of the tubes is the method of steam cleaning usually adopted in these boilers. This steam jet leaves the tubes damp, which naturally aggravates any tendency to rust.

In the *Don Carlos* the tube-sweeping arrangement was taken from the compressed-air pipes used in connection with the armament. This gives a perfectly dry air jet at high pressure, and proved a most efficient cleaner without the above objectionable feature. The feed system already described has the disadvantage of a large number of pumps, but in all other respects is very simple, and unlikely to become deranged. The area of water level also is large relatively to the quantity of water in the boiler, and this area is naturally the measure of the difficulty of steady feeding.

As to the possibility of working with salt water as make-up feed, our experience has certainly been against it in both the water-tube boilers considered. A serious tendency to prime, except at very low powers, is produced by even a small admixture of sea water, and anything approaching continuous use would be, in the writer's opinion, most undesirable. This is evidently borne out by experience, as the British Admiralty have recently taken special precautions in all their vessels to minimise the risk of salt water entering the boilers through inadvertence, or without the special knowledge of the officers in charge.

Facility for Overhaul.

In this respect the Belleville type has a great advantage, viz., the readiness with which complete elements can be taken from the boiler, repaired in the stokehold, and replaced. The other parts of the boiler are also of small dimensions, and, in case of a serious accident, the whole boilers can be taken out of the ship through the usual air casings without disturbing decks, &c., and with very slight derangement of even the minor fittings. The examination of the inside of the tubes, however, involves breaking and remaking a large number of joints.

As to the Yarrow type, the operation of renewing a tube is by no means difficult, although, if the defective tube is in the middle of a nest, all the tubes between it and the outer edge of the tube plate must also be removed. The method adopted is to work the tubes from hole to hole alternately between the two tube plates until the outer edge is reached. If, however, time is of importance, the tube ends can be plugged and steam raised again rapidly without any injury to the structure.

The inside of the tubes can be readily seen through and cleaned, owing to their being straight. This examination is merely a question of minutes, and thus is likely to be more frequently made than if considerable time and trouble were needed. It also involves the breaking of no joints, except the manhole doors. The outsides of the tubes are certainly not easily examined, and it is wise from time to time to remove a tube here and there to judge of the condition of

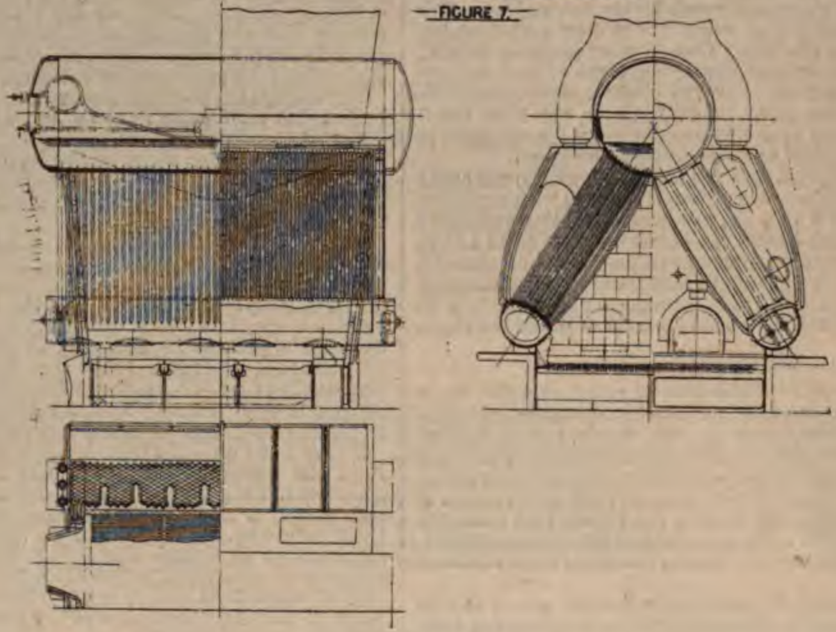
In the case of a serious accident, or seri
tating the retubing of a large p

would doubtless be slow. It is not a contingency likely to arise and in any boiler would necessarily be a dockyard repair.

Referring to the cylindrical boiler, the capabilities of this type for ordinary examination and overhaul are well known. For heavy repairs, however, such as renewing a furnace or flame box, the process is both tedious and costly, and in the extreme case of removing a boiler from the ship the whole of the protective deck and superstructure in way of the boilers has to be removed

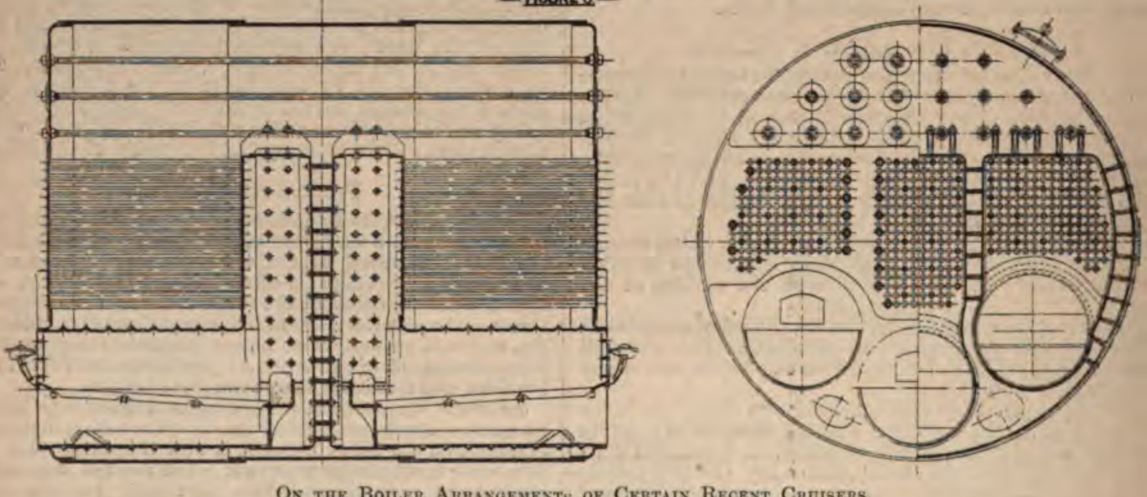
DON CARLOS I.

—FIGURE 7.—



"HAI CHI."

—FIGURE 8.—



On the Boiler Arrangements of Certain Recent Cruisers.

Steam Pressure.

With the water-tube types, the pressure of 300 lbs. per square inch is now customary. Such pressures are not practicable, except with water-tube boilers, without enormous increase of boiler weight, and have the advantage of enabling smaller engines to develop the necessary powers, with the attendant advantage of relative economy at low powers.

In cylindrical boilers the best balance of weight, power, and space economy appears to be obtained by using about 155 lbs. steam pressure. The additional economy in the engines, by using such higher pressures as are possible with these boilers, is not sufficient to justify the additional weight of boiler due to such higher pressures in vessels in which coal consumption is to some extent of secondary importance.

General Conclusions.

The above comparisons appear to lead to the following general conclusions in the case of the three types of boiler considered, starting on the basis of equal space occupied.

The Belleville type is well adapted for maintaining high continuous sea speeds for long periods, and is very economical at high powers. It is comparatively light, and well arranged for cleaning and overhaul. Steam can be raised quickly, and large variations in power made readily. It cannot, however, be forced, and has also the objection of great complication of detail and accessories, with consequent liability to derangement.

The Yarrow type is hardly so well adapted for continuous steaming at relatively high powers, and is not so economical* under such circumstances. It can, however, be forced to almost any extent with safety, and much higher speeds obtained for considerable periods. Steam can be raised quickly, and

---

*** More recent Yarrow boilers, fitted with Mr. Yarrow's feed-heating arrangement, are fully equal to the Belleville type in economy.**

large variations in power made readily. It is extremely light, and, being simple in detail, has small liability to derangement. Cleaning and overhaul are fairly easy, but the examination of the outside of the tubes is difficult.

The cylindrical type is about equal to the Yarrow for continuous high-power steaming, though probably slightly less economical. At low powers, however, it is very economical. It can be moderately forced with safety, and is well adapted for ordinary cleaning and overhaul. All its arrangements are extremely simple, and unlikely to become deranged. Sea water can be used in it with safety. It is, however, heavy; steam can only be raised very slowly, and large variations in power cannot be made quickly.

The above conclusions, the writer submits, point to the fact that the boiler question is one which must be dealt with in its relation not only to each individual class of ships, but to each individual service. The adoption of any type will depend upon what particular qualities are most desirable for the boilers to possess to meet the special work which the vessel is designed to do. The general naval policy of any Power will thus have a direct bearing upon the question of what type of boiler is preferable for a given ship.

In conclusion, it may be added that the three types considered are given merely as a comparison of actual examples of typical boilers, and are not put forward in any spirit of comparison with other types of boilers or other systems of working.

The writer wishes to take this opportunity of thanking Sir William White, K.C.B., Sir John Durston, K.C.B., and Colonel Watts for their kindness in allowing him to make public the facts contained in this paper.

Name of Ship	*Andromeda.*	*Hermes.*	*Don Carlos I.*	*Hai Chi.*	*Æolus.*	*Pallas.*
Number and type of boiler fitted	30 Belleville	18 Belleville	12 Yarrow	8 cylindrical. 4 D.E. & 4 S.E.	5 cylindrical. 3 D.E. & 2 S.E.	4 cylindrical. D.E.
Steam pressure in lbs. per square inch ..	300	300	300	155	155	155
I.H.P. with natural draught[*]	16,500	10,000	8,000	12,000	7,000	5,000
I.H.P. with forced draught	—	—	12,500	17,000	9,000	7,500
Total heating surface in square feet	40,140	24,050	32,004	27,558	15,947	11,040
Heating surface per I.H.P. natural draught ..	2·44	2·405	4·0	2·3	2·28	2·2
Heating surface per I.H.P. forced draught ..	—	—	2·56	1·62	1·77	1·475
Total grate area in square feet	1,439	750	587	940	560	406
Length of fire bars	6 ft. 3 in.	6 ft. 3 in.	7 ft. 3 in.	7 ft. 1½ in.	7 ft.	7 ft. 3 in.
I.H.P. per sq. foot of grate, natural draught ..	11·47	13·33	13·6	12·78	12·5	12·3
I.H.P. per sq. foot of grate, forced draught ..	—	—	21·3	18·1	16·05	18·4
Total boiler-room area in square feet	4,925	3,100	2,440	3,470	2,230	1,900[†]
I.H.P. per sq. foot of boiler-room area, natural draught	3·35	3·22	3·28	3 46	3·14	2·63
I.H.P. per sq. foot of boiler-room area, forced draught	—	—	5·12	4·9	4·03	3·94
Heating surface per square foot of boiler-room area	8·15	7·77	13·1	7·94	7·16	5·82
Grate area per square foot of boiler-room area	·292	·242	·24	·276	·251	·214
Grate area per sq. foot on basis 6 ft. 3 in. bars	·292	·242	·207	·242	·22	·185
Total weight of boilers, uptakes, and funnels, in tons	559	342	217	447	270	174
Total weight of water in boilers, in tons ..	43	30	30	197	103	82
Total weight of pumps, pipes, connections, water in feed tanks, &c., in tons	168	100	82	97	55	41
Total weight in boiler-rooms in tons	770	472	329	741	428	297
Weight in boiler-rooms in lbs. per I.H.P., natural draught	104	105·5	92·2	138	137	133
Weight in boiler-rooms in lbs. per I.H.P., forced draught	—	—	59	97·4	106·3	89
I.H.P. per ton of boiler-room weight, natural draught	21·4	21·19	24·3	16·2	16·4	16·8
I.H.P. per ton of boiler-room weight, forced draught	—	—	38·0	22·9	21·1	25·2

[*] Natural draught here implies the usual Admiralty conditions, in which an air pressure of ½ in. of water column is permitted.

[†] Boiler rooms very large in this vessel.

Board of Trade Examination.—At the recent Board of Trade examination for extra first-class engineers, two of the successful candidates, Messrs. Charles Agate and Louis J. Leblique, were students at Leask's Marine Academy.

INSTITUTION OF NAVAL ARCHITECTS.

THE summer meeting of the Institution of Naval Architects was opened on July 18th in the Town Hall, at Newcastle-on-Tyne, at 10.30 a.m. The President of the institution (the Earl of Hopetoun, G.C.M.G.) and the members of the council met the members of the Reception Committee, headed by the Mayor of Newcastle (Mr. George Harkus), in the Council Chamber, and were conducted to the platform of the Town Hall, in which a large company, including many ladies, had assembled. At the commencement of the meeting the chair was occupied by the Mayor, who was supported on his immediate right by the Earl of Hopetoun, and amongst those present were:—The Earl of Ravensworth (past president of the institution), Sir W. H. White (Director of Naval Construction), Sir John Durston, Sir Edward J. Reed, Mr. F. K. Barnes, Mr. James Dunn, Dr. Francis Elgar, Mr. J. I. Thornycroft, Mr. A. F. Yarrow, Mr. S. W. Barnaby, Professor J. H. Biles, Sir Raylton Dixon, Sir Andrew Noble, Mr. W. T. Doxford, M.P., Mr. D. J. Dunlop, Mr. J. M'Farlane Gray, Mr. James Hamilton, Mr. John Scott, Mr. Philip Watts, Mr. Henry H. West, Mr. John Corry, Mr. James Riley, Mr. G. B. Hunter, Mr. Robert Thompson, Herr F. Laeisz, Sir Benjamin Browne (President of the North-East Coast Institution of Engineers and Shipbuilders), Admiral Cleveland, Colonel H. F. Swan, Mr. J. Duckitt, Admiral Carr, Captain Coerper (German Naval Attaché), Mr. John Gravell, Mr. T. V. S. Angier, Herr Otto Schlick, Mr. H. A. B. Cole, Mr. E. T. Agius, &c., with Mr. George Holmes, the secretary to the institution.

The Mayor of Newcastle, in welcoming the institution to the city, said: My Lords and Gentlemen,—I cannot conceive a more appropriate place than this old town on the banks of the Tyne for a meeting of members of the Institution of Naval Architects. The Tyne has been the scene of the wonderful progress made in the past half century in the designing and building of craft of all kinds, from the slender skiff used by the noted oarsmen of the north to the majestic leviathan launched a few weeks ago from the Elswick Yard for Japan—the England of the East. The Tyne is also the scene of the vast improvements made in marine engines, the latest type of which is to be seen in Mr. Parson's *Turbinia.* The programme arranged for you will enable you to see the great works of the North, commencing with the Elswick Works; and you will also have the opportunity of seeing the beauties of this city and of Northumberland. This city is indebted to Lord Armstrong for one of the most beautiful spots in the North of England—I mean Jesmond Dene. There is beauty everywhere you go, in every step you tread. The Mayoress and myself hope to have the pleasure of receiving you in Jesmond Dene this afternoon, and I am sure a sight of the beauties of the Dene will enable you to carry away a pleasanter picture of this old town than would be the case if your visit were confined to its great workshops. On behalf of all the citizens, and more especially on behalf of my colleagues in the Corporation, I offer you a most hearty welcome to Newcastle.

The President (the Earl of Hopetoun, G.C.M.G.), in reply, said: Mr. Mayor, and Gentlemen of the Reception Committee,—In the name of the Institution of Naval Architects, I desire to thank you most warmly for the kind words of welcome which your worship has just spoken, and for the spirit of hospitality which has led you to prepare the splendid programme which I see before me for our entertainment and instruction. Gentlemen, we who are members of the Institution of Naval Architects are no strangers to Tyneside hospitality. We have had previous experience of your goodwill towards us; for, twelve years ago, we held one of our most successful summer meetings in this city and in Sunderland. Those of us who had the good fortune to be present at that meeting can never forget the kind treatment which they then experienced at your hands. They have evidently spread the fame of their reception abroad; for, when it became known that the council had accepted another invitation to visit the Tyne and the Wear, an unprecedented number of applications was received from our members to attend the meetings. I only trust that the eagerness with which the institution has availed itself of your kindly intentions towards us has not put too great a strain upon the indulgence of the Reception Committee. During the period which has elapsed since our last visit, neither the industry of your port nor the prosperity of our institution has stood still. Both have increased by leaps and bounds, and we meet again after a twelve years' interval, neither being the worse for wear. Though your port is one of the oldest in the kingdom, though you supplied 27 ships to King Edward the Third's Navy five and half centuries ago; though you have been exporting coal by sea for more than six centuries, nevertheless you show no signs of having yet reached the limits of your growth. Within the lifetime of the present generation you have by your energy so improved your river as to render it available for all the purposes of modern commerce and of shipbuilding on the largest scale. Your yards and engineering works are being continuously increased in size and perfected in equipment. If I consider the products of these works and yards I cannot fail to be struck by the many important changes and developments which have taken place even during the short interval which has elapsed since the date of our last visit. The types of battleships and cruisers, the offensive power of naval artillery, the defensive power of armour, the size and types of merchant steamers, the means of generating and utilising steam, and even the machinery of production, all show the most remarkable advances. I will not allude in greater detail to these matters, because we are to be favoured with papers on many of them by such authorities as Sir Andrew Noble, Mr. Yarrow, Mr. P. Watts, Mr. F. J. Marshall, and Mr. G. B. Hunter, to whom our best thanks are due for doing so much for our professional instruction. I cannot, however, help looking ahead, and wondering if the next dozen years will bring us equally great changes; nor can I withhold my sympathy from my friend, the First Lord of the Admiralty, who has, in the interests of the British taxpayers, publicly expressed the hope that the great army of inventors would have mercy on the administrators, and not push them too hard. It gives me great pleasure, whilst congratulating you on the marked evidence of progress to which I have just alluded, to report to you that the institution over which I have the honour to preside, has also made rapid strides forward since last we met in this city. The numbers of our members have greatly increased. We have visited many British ports in the last few years, and we have even gone beyond our own islands, and have been received with the utmost good feeling by our fellow members in France and Germany, and by the Governments of those great countries. I mention these matters because we attribute no small share of our present activity and prosperity to the policy which we have adopted of visiting our colleagues at the great shipbuilding and mercantile ports. In this way we gain many sympathetic friends and supporters, to whom the institution would be a mere name if it remained always in London, and we enable many of our members, who could not otherwise do so, to participate directly in our work. Therefore, we feel that, in inviting us to visit you on the Tyne, you are contributing directly to our prosperity, and you are aiding us in a marked degree in carrying out the objects of our existence. Whilst on the subject of the institution I should like to say how rejoiced all we, your guests, are to learn of the growing prosperity and success of the North-East Coast Institution of Engineers and Shipbuilders, which has its seat in this city, but which does such excellent work all over the North-Eastern district. I have myself the honour to be an honorary member of that institution, and take the deepest interest in its success, an interest which is shared by all the members of the body which I represent. We both seek the same beneficent ends by the same methods. This constitutes in itself a bond of union between us; but we have, in addition, the associations of old friendship formed on the occasion of our former visit, and now happily to be renewed. We feel ourselves particularly fortunate in that Sir Benjamin Browne, who, as mayor of the city, received us with such open-handed hospitality in 1887, should this year be President of the North-East Coast Institution, and should in that capacity again take an active part in welcoming us here. Gentlemen, I cannot conclude without expressing my feelings on one other point. I am sure that every member of the Institution of Naval Architects who knew Lord Ravensworth in his capacity as its president, and who appreciated, as we all did, the great services which during 14 years he rendered to our society, will feel heartily rejoiced to see him once more amongst us as he is to-day, still active in serving our interests, still feeling the deepest sympathy with our work, and still, I am happy to say, looking hale and hearty. In the name of all of you, his old colleagues, I thank him for what he has done for us, and I wish him long years of health and happiness, and hope that he will continue to aid us from time to time by his presence and with his influence. There is one face familiar to most of you which we miss from amongst us to-day. I allude to our vice-president, Lord Armstrong, the founder of the great firm which is doing so much for our benefit, and who is prevented by his great age from playing the same prominent part which he did on the last occasion. But, though unable to be present, Lord Armstrong's thoughts are with us, and, as he cannot come to us, he has most kindly invited us to go and visit him in his beautiful home. I propose to send him, with your permission, the following telegram:—"The Institution of Naval Architects, assembled at its summer meeting at Newcastle-on-Tyne, sends its warmest wishes for the health and happiness of its vice-president, Lord Armstrong, and assures him that, though absent, he is not forgotten." Mr. Mayor, when we look down the list of the Reception Committee, and take note of the numerous and important interests which are there represented, and which have combined to do us honour, we cannot but feel flattered and grateful, and we draw the encouraging conclusion that you regard the work we are engaged on as being of the highest importance to the country and to your district.

Lord Hopetoun then assumed the chair as president of the institution.

Progress of Rifled Naval Artillery.

Sir Andrew Noble, K.C.B., read a lengthy paper on "The Rise and Progress of Rifled Naval Artillery." At the last meeting which the Institution of Naval Architects held in Newcastle a paper by Lord Armstrong and Mr. Vavasseur, on this question, was read and discussed; and, using that paper as a landmark, Sir Andrew Noble now gave a sketch of the subject during the 50 years of his connection with artillery, and noted the striking progress which artillery science, in common with other applied sciences, had made during the last years of the century now drawing to a close. In concluding his paper Sir Andrew said:—From the numerous experiments made, either by ourselves in this country, or by others elsewhere, I draw the following conclusions:—(1) To attack unarmoured structures, I have no doubt that shells charged with high explosives are a most formidable weapon. The large quantity of explosive that can be carried, and the power of immediately detonating the shell, permit the vessel to be attacked either by making large holes at or near the water-line, or if the shell should burst inboard the effect of the explosion and the destruction of everything in the wake of the shell would be very serious. (2) But with high explosives the shells are reduced to very small fragments, and even very thin steel plates resist penetration. Hence the importance of traverses, and supposing a first-class cruiser to engage two smaller cruisers firing high explosives, one on each broadside, a longitudinal traverse of very moderate thickness would be a protection, the importance of which could hardly be overrated. (3) Having regard to the size of the holes made by high explosives in unarmoured structures, I regard it of great importance that, wherever possible, the water-line should be protected from stem to stern with such armour as can be conveniently carried, and that the same protection should be afforded where the guns are carried on the main deck. On the upper-deck effective shields, and as thick as can be conveniently carried, should be attached to the mountings. (4) Where an attack is made against thin armour, shells charged with gunpowder are more effective than high explosive shells, as, dependent on circumstances, the former can be got to pass through thin armour and burst inside. I doubt if shells charged with any explosive can be got to pass through thick armour without bursting. (5) There is one serious objection to certain high explosives as bursting charges which is not shared by wet gun-cotton, and that is the liability to detonate if struck by another projectile, or even by a large fragment. Wet gun-cotton is quite safe in this respect, and yet, if fired, for example, by a fulminate, it detonates even more rapidly than in the dry state. This property has led certain Governments to adopt it as the high explosive for use on board ship. In concluding this paper, I desire to defend our Elswick practice, which I have sometimes heard attacked, of mounting as many guns on the broadside as can be conveniently carried. Personally, I share strongly the opinion which a distinguished admiral once made to me: that, supposing a fight between two cruisers equally ably commanded, the victory would remain with the ship that got in first her second broadside, and the victory would be more assured if the broadside were the more powerful. It must also be remembered that with our modern weapons allowance must be made for a gun or two being disabled without altogether crippling the broadside. For these reasons I prefer to carry as many guns as possible, even if the number of rounds carried per gun be reduced.

Sir **Edward Reed** characterised the paper as a wonderfully full record of the progress of war material in connection with the naval service. He regarded it as the very fullest and best record of work in connection with naval gunnery that they had ever had. The paper would be very valuable to him as one engaged in the practice of a profession most intimately connected with it. He discerned in the paper a disposition on Sir Andrew's part to open his mind and his hand more extensively than had ever been done before in that connection. No doubt the exceptional and paramount position of the Elswick Works was due to the circumstance that they had been constantly progressing in connection with ships and guns and gun mountings, and it was only natural and proper that a great firm, expending not only large sums of money, but the highest talent and the talent of many men in developing a business of that kind, should be somewhat reluctant to disclose the processes of their thought and of their action. Sir Edward went on to mention that, in 1863, when he went to the Admiralty, the guns of H.M. ships were moved about by exactly the same means by which a savage moved a log of wood at the beginning of the world. He succeeded in inducing the Admiralty to put a 12½-ton gun on board the *Bellerophon*—4¾-tons was the largest one previously. He also introduced mechanical means of working the guns, instead of the primitive method of "prising" it round with a hand-spike or stick.

Sir **William White** said that in the paper read they had the record made by the men who had done the work. The feature of the paper which most struck one who read it was the extremely modest way in which the great work was described. He was glad that Sir Andrew, in telling the story of the triumph of mechanical engineering as applied to naval armaments, had uttered a word of warning, and had said that, while mechanical appliances were a necessity, there should be no such extension of them as would attempt to turn the men into machines—into mere regulators of machines. It must be "the man behind the gun." In that the strength of the British Navy had always consisted, and always must largely consist. If the old resource and power of meeting emergencies were to be in any way destroyed by dependence upon mere machinery, that would be a matter which they must all regret. In the course of his duties it was not uncommon for him to attempt to introduce a limit to the extension of mechanical appliances. Sir Andrew had necessarily spoken most of the means of attack. Some of them had to consider not merely attack but defence, and there was nothing more difficult in watching the progress of invention than to know exactly where at any moment to strike the happy mean of developing the idea that offence was often the best means of defence, or of trusting to some extent to passive defence. The attack must always have greater flexibility than the defence, as Sir Andrew would agree. Those who were interested in the design of warships would be grateful to a man of the large experience and great ability of Sir Andrew Noble for putting before them, in that succinct, clear, and admirable form, his views on the problems of the present, and the prospects of the future.

On the motion of the **Chairman**, Sir Andrew was thanked for his paper.

Pressure on Dry Dock Blocks.

The "Fulda" Accident.

Dr. **Francis Elgar** read the next paper, and took as his subject "The Distribution of Pressure over the Bottom of a Ship in Dry Dock and over the Dock Blocks," which we refer to in our Editorial Notes.

The **Secretary** (Mr. Holmes) read a communication from the engineer to the Mersey Docks and Harbour Board, who said that it was by his advice that Dr. Elgar was consulted in the matter originally; and, after talking it over, they mutually arrived at the conclusion that the subject ought to be ventilated; and Dr. Elgar was the right man to do it, and the meeting of the institution presented a fitting opportunity. He congratulated Dr. Elgar on the fulness with which he had treated the matter, and trusted that the facts and figures laid before the meeting would be carefully studied by those who were responsible for the important process of dry-docking vessels. He was convinced that many vessels in the past had been dry-docked with a very small margin of safety; and it was very desirable that an operation so important should receive more than the general rule-of-thumb consideration which it appeared to have had hitherto.

Professor **Biles** stated that he had been one of the interested observers of the result of the *Fulda* accident, and of the legal inquiry which followed it. The question of the pressure which was brought on the forward block when the ship was docked with a large unsupported length was one which, at first sight, would seem to be very simple of solution. A common way of looking at that problem was to say that, if they had a ship which was a little overhung, and they gradually increased that overhang until the middle of the ship rested on the forward block, she was at a balance at that point, and consequently they might have the whole weight of the ship concentrated on what they might call the forward block. As they got less overhanging, they got the amount proportionately reduced, but still a very large proportion of the total weight of the ship—in the case of the *Fulda*, a ship weighing 6,600 tons. It would appear, in the first place, as if the pressure on the forward block might be something like from one-half to one-fourth of the weight of the ship, when one-fourth of the ship was overhanging. That method of considering the question was one based on the assumption that the blocks on which the ship rested were rigid blocks. If they assumed the ship to be slightly flexible, and the blocks to be rigid, undoubtedly a very large pressure would come upon the forward block. That pressure could be calculated, and, on that assumption, the pressure in the case of the *Fulda* would amount to something like from 1,000 to 1,200 tons, roughly speaking. If they assumed that the force was acting on the forward block, and that they then allowed the blocks to pass from the severely rigid condition to a perfectly elastic condition, then the forward block immediately sank down by the excessive weight put upon it, but that brought into play the elasticity of the next block, and so they got the support transmitted from the forward block right on. If they had 1,000 tons put on the forward block, and they had a ship supported for 300 ft. of her length, then they would have, roughly, about three tons per foot of length as the mean force that that unsupported overhanging would bring on the forward block.

Sir **Edward Reed** remarked that Mr. Lyster would make it an accepted fact that the forward blocks failed, first because of an excessive pressure on the foremost block. That was not by any means a foregone conclusion in his (Sir Edward's) own mind. The *Fulda* herself had been dry-docked several times on other blocks, with no evil results, and with the same overhang, of course. The impression created upon his mind was that the best evidence went to prove that the foremost block did not fail first. The blocks which first failed were abaft the middle of the vessel according to eye-witnesses. The vessel had a great, but not an excessive, overhang. With the investigations which had been put before them it stood to reason that the pressure forward must have been greater than the pressure aft. Dr. Elgar would say that, with such an overhang as that, the docking parties should have been notified of the great overhang, and there he was in agreement with the speaker who thought that everybody taking an exceptional ship like that would do well, and ought, to give notice of the exceptional overhang, so that the parties might provide such additional blocks as might be necessary. The blocks used for the *Fulda* were of cast-iron, very old, much worn, decayed, and originally of bad design. The improvement in the design of the blocks which had now replaced them tended to remove a weakness which the original blocks possessed. The first blocks were so weakened in the middle as to be very ill-adapted for the pressure of a bar-keel. Whatever might have been the cause of that failure, they would freely admit that it would have been better to have had notice given of the overhang. While it was undoubted that there must have been a heavy pressure on the foremost blocks, yet at the same time, as there was reason to think, the first failure did not occur there. It might have happened that the failure did not take place at all, in this case, from the pressure upon the foremost blocks, but from the original weakness of design, from great wear and tear, and that the *Fulda* cut through the blocks beneath her and fell to the bottom of the dock, because the blocks were not strong enough to sustain her.

Mr. L. Clark described a method he had devised for estimating the pressure of a ship on her keel-blocks under certain assumed conditions. As a result of his investigations, he had concluded that those docking ships should beware of cast-iron blocks; if the blocks had been all wood, the accident to the *Fulda* would not have happened.

Mr. H. H. West declared that the result of the inquiry respecting the *Fulda* accident had not altered his opinion one iota as to what exactly did happen. Mr. Lyster's memorandum mentioned the fact that the ship was damaged, and damaged excessively, at the fore end, and concluded from that that it was the fore end which went down first. He (the speaker) concluded that the vessel went down at the fore end last for two very good and sufficient reasons, amongst many others. There was one man, and one man only, who was found to have been in a position to make a competent observation of what happened, and neither the one side nor the other could find a second to him. Under closest cross-examination he did not give way one least bit from the story he told at first, and that was that he saw—after his attention had been called to the subject by the cracking noise some 14 or 15 minutes before the accident happened—whilst watching very carefully, the blocks fly out at the after end of the ship and then the vessel come down forward. The ship was most severely damaged at the fore end. He thought that they might conclude that the ship must inevitably have come down with the fore end last. If the vessel was resting heavily on the blocks about number 24, and this gave way first, numbers 24, 25, and 26 would gradually yield, one after the other, and bring into play 23, 22, 21 and 20, gradually crushing as the vessel went down into the dock. He, coming from Liverpool, should be the last to cast any aspersion upon the blocks which were used. He had his own opinion, but he was convinced that the lesson that had been learned from the *Fulda* would make it practically impossible for any such casualty to occur again, either in Liverpool or in any other place.

Professor Hele-Shaw gave a lengthy demonstration, with the aid of the blackboard and mechanical contrivances, of the causes of strain on docked vessels.

Dr. Elgar replied, and said that with reference to the manner in which the *Fulda* went down, he did not wish to argue that there. He might, however, have revealed his opinion in the course of his paper. His opinion was based upon this, that, upon any reasonable method of calculation, the more one saw of these stresses upon the foremost blocks, the more one was convinced that there was not the slightest doubt that the region of greatest pressure was in the neighbourhood of the foremost blocks. These blocks, which had been in use for something like 40 years, had never yet been objected to by anyone. The Board was now surprised to learn that these blocks were defective, and, wishful of light, wanted the opinions of the institution on the matter. An objection to that kind of block, as compared with blocks made of wood, was that the power of the blocks to distribute strain was limited.

The institution accorded a vote of thanks to the author of the paper.

Mr. Nelson Foley's paper on "A New Method of Forced Draught," taken as read, is referred to in our Editorial Notes.

This terminated the morning meeting.

In the afternoon the members of the institution and their ladies were entertained to a garden party in Jesmond Dene, their hosts being the Mayor and Mayoress of the city.

In the evening the dinner of the institution, held in the large hall of the Assembly Rooms, was largely attended, and most enjoyable.

The members reassembled in the morning of Wednesday, July 19th, in the hall of the Literary and Philosophical Society, for the reading and discussion of papers. The President (the Earl of Hopetoun) occupied the chair, and there was a large attendance.

At the commencement of the proceedings the meeting approved the election of 107 gentlemen as members, associate members, and associates; and

The President informed the meeting that this was a record number to be elected, a fact of which, he thought, the institution might feel very proud. Mr. Watts had been an excellent recruiting sergeant, and had brought quality to the institution as well as quantity, for he had induced a number of distinguished gentlemen to join the society.

Elswick Cruisers

Mr. Philip Watts, the chief of the shipbuilding department at Elswick, read a paper on "Elswick Cruisers," which we propose publishing in full in our next issue.

Admiral Sir Edward Freemantle stated that, during the war between China and Japan, he was very much struck with the manner in which the Japanese cruisers—Elswick-built—were worked. During the attacks on Wei-hai-Wei and Port Arthur, if the cruisers remained in port a few hours it was as much as they did. When the Chinese torpedo-boats tried to make a dash for Wei-hai-Wei, the flying squadron came out, headed by the Elswick cruisers. These vessels did the most cruising, and the most successful cruising, during the war. He was glad that Sir William White was present, for that gentleman would be able to explain how it was that the vessels of the *Terrible* class, which were so much larger, were, to put it plainly, less powerful. With regard to coal and ammunition supplies, he believed that not only should there be colliers attached to every fleet, but there should also be ammunition ships and hospital ships. He believed that, nowadays, they should look round the ships and see what they could dispense with, such as above-water torpedo-tubes, &c. The same remark applied to the four anchors and cables. When one asked the Admiralty to take one anchor away, the Admiralty replied, "Oh, no, that ship always had four anchors." But the new ships had only three. He wished they had some of the Elswick cruisers in the Royal Navy.

Professor Biles said that when they had a large organisation everybody connected with that organisation found some fault in, and wanted to improve, a ship, and necessarily when a new ship came to be built all the faults that had been found must be avoided, and all the improvements that had been suggested must be put into the new ship. With a large number of people, each having things in view, a great many things would get into the vessel which, if they were left to the judgment of a single man, would probably not be added. If some of the Admiralty ships were heavier than some of Mr. Watts's, it might be that that was owing to the desire of everyone connected with the service to have something added to these ships.

Sir Edward Reed said that this paper seemed to him to take rank with the paper of Sir Andrew Noble, and in a large measure to complete the record of the Elswick Works. As the Elswick Works were by far the most important concern in that district, and occupied a high position in the world, he thought that those present might congratulate themselves on coming to Newcastle, and on having been met by that great establishment with the presentation of papers of such importance. As he had been connected with several of the vessels mentioned in the paper, it would not be inappropriate for him to say a few words upon the important and delicate points on which the debate had touched. Admiral Freemantle, in the spirit of gallantry and courage which had always animated him, had gone straight to the point, and wanted to know how it happened that there was such a remarkable contrast between the Elswick cruisers and the Admiralty vessels. In so far as the *Esmeralda* and the *O'Higgins* were concerned, they, such as they were, had come about as follows:—It had been his duty, on behalf of the Chilian Government, which ordered these ships, in association with the Chilian admiral, to define fully the requirements of the Chilian service and to invite tenders and designs for the vessels. When these came in they were very closely examined, and the success of the Elswick Works in obtaining orders for these ships was entirely due to the merits of the designs judged by these considerations, which the owner of a cruiser would naturally bring into account. Mr Watts had been asked by Professor Biles to give fuller details of the weights. He would like to see whether they could not, before a future meeting of the Institution, get someone to exert his persuasiveness with Sir William White on the one hand, and with Mr. Watts on the other hand, and get them to freely disclose all their statements of weights, and to make them the subject of a special paper to be read before that institution. He thought that the Elswick designs owed much of their excellence to the fact that Mr. Watts had succeeded in making every necessary element of protection available for strength as a special matter of study, It was possible to design a ship, and then to begin to think about its protections and the things it had to carry. He was sure that the most lynx-eyed architect could not discover in the Elswick ships any wasted weights. These ships owed much of their merit to very great mastery with respect to their form. This very great excellence of form was accounted for by the able knowledge of the designer. He was not aware of any undue economies of weight in the Elswick designs. Sir William White had not the same freedom that Mr. Watts had in connection with the designing of ships. The Admiralty and many others had a voice in the design, not to mention Sir William's subordinates. He appealed to Sir William White and to Mr. Watts to contribute, perhaps jointly, a paper on a future occasion setting forth the real secrets in that matter, and explaining why the Elswick ships differed from the Admiralty ships. The most recent Admiralty ships were much nearer to the pretensions of the Elswick ships than any had ever been before. That might have been because of the letters which he had been writing to the *Times*, saying that something ought to be done. He sympathised with Sir William White in the fettered position in which he was placed.

Sir WILLIAM WHITE, on rising to continue the discussion, was loudly applauded. He said he would like, at the outset, to say how much he was touched by the deep sympathy of Sir Edward Reed. It would be a great misfortune if the proceedings of that Institute degenerated into a criticism of the professional capabilities of any of its members, or that it became a medium for discussing, on very imperfect information, Admiralty policy. His friend and successor at Elswick, Mr. Watts, whose appointment he was glad to say he had the honour of arranging when he returned to the Admiralty, and whose subsequent career had more than justified all the high hopes that he (the speaker) then had of his (Mr. Watts's) future, had read a very capable paper. It seemed to be forgotten that, before the speaker returned to the Admiralty, he had the honour of working with and for the Elswick Co. for some years, and contributed, in some degree at all events, to the formation of that great establishment. He might be supposed, therefore, to have a fairly full knowledge of Elswick methods as well as of those of the Admiralty. He had a full knowledge of the principles upon which the Elswick ships were designed, and he had full and the latest knowledge of Admiralty policy and of Admiralty methods. He wanted to express his sincere admiration of the professional skill which was shown in Mr. Watts's designs. Admiral Freemantle rejoiced in a newly acquired freedom. If the Admiral and other naval officers of eminence would devote their energies to helping those who had to design ships to carry out this economy of weight and equipment, the naval architects would be much obliged. Working at Elswick, in close touch with the engineers, they were working also in the closest touch with colleagues who had everything to do with ordnance, gun mountings, and the armaments of ships in every detail. Those who had not had that advantage hardly knew how much they missed. It had been his lot to have held up for his admiration and imitation, in the Admiralty, ships for the design of which he was responsible before he went to the Admiralty. The gain which Mr. Watts must have had in his professional work from his early association with the late Mr. Froude no one could know better than he (the speaker) did. He would like to remind the meeting, however, that he had behind him at the Admiralty the most perfectly equipped experimental establishment in the world. He took exception altogether to the suggestion that in the Admiralty one was at a disadvantage in the selection of form. Quite the contrary. Was it to be suggested that the Admiralty officers were in any way behind the times with regard to structures and materials of warships? He claimed that they were prepared to face comparison with the world. Propulsion was largely a matter in which they were dependent upon the marine engineers for skill, enterprise, and constant progress. Was there any justification for the suggestion that in Admiralty practice as regards marine engineering they were failing to advance? The charge that was most frequently made at present was that they were advancing too fast. As to the disposition of the weights which came into armament, equipment, and protection, there might be infinite opinions as to the form of the best distribution. They had heard from Admiral Freemantle of what he considered to be the insufficient armament for some of their ships. They might have quadrupled the number of guns in the *Powerful*, but would they have increased the fighting efficiency? If history was to be trusted, all naval actions had been determined by the slaughter of men or by the loss of *morale* and fighting power of the men on board the beaten ships. Whilst active offence was a valuable quality it was important to consider the question of defence. They did not know how the disposable weights of the Elswick ships were disposed, and, if he were Mr. Watts, he would not tell them. As to speed, it was the commonest thing for him to see tabulated statements of speeds of ships which rested upon no common measure whatever, neither of the power developed, nor the condition of the ship at the time of trial, nor the duration of the trial, nor, in some cases, the means of testing the speeds. In steam trials of warships, "jockeying" was not yet extinct, but the Admiralty did not "jockey." He did not want them to think that he was applying these remarks to the Elswick steamers. If any one, accepting the conditions laid down for the design of any vessel belonging to the Royal Navy, for which design he, the speaker, was responsible, could show him how, taking the conditions at the time at which the ship was designed, he could produce a vessel superior to the design which was then accepted, he should be very glad indeed to see that demonstration. He was not infallible. He could only claim that he had not spared himself in the public service. If he had sought his comfort he should never have left the Elswick Works. Elswick was the place above all others where a man could work free from any limitations which must be enforced elsewhere. It had been his business to inform himself of the work of others, and he publicly acknowledged the enormous obligations under which he laboured to his professional brethren outside the Admiralty, and amongst these he included Mr. Watts.

Colonel WATTS replied. He mentioned that Professor Biles had referred to the question of strength and weights. He ventured to think that the weights had not been cut down beyond the proper limit. His firm did not propose to give their weights. Nor did they propose to give their specifications and drawings. They had given their results, which he was prepared to affirm were accurate. There was no "jockeying" about them.

BOILER ARRANGEMENTS IN CRUISERS.

Mr. F. T. MARSHALL read the next paper, "The Boiler Arrangements of Certain Recent Cruisers," which we publish in full in this issue.

Sir JOHN DURSTON congratulated the author—the son of an old friend of the members, Mr. Frank Marshall—on the very fair manner in which he had drawn up his paper.

Mr. YARROW thought that Mr. Marshall had dealt very fairly with the merits and objectionable features of the different types of boilers. The paper was particularly valuable at the present time, because everyone was interested in water-tube boilers and were all ready to grasp at any information that they could get upon the subject. His firm attached great importance to the bell-mouthing of the tubes. The bell-mouthing was the last opportunity that they had of testing the ductility of the tubes. At the last operation of bell-mouthing, some few of the tubes would be found to split, and it gave them the last opportunity of discarding the faulty ones. Mr. Marshall had said that any information which anyone could give which would tend to increase the durability of the tubes, on account of their comparative thinness, would be welcome. As that was the subject which he (the speaker) proposed to deal with at the present meeting, he would not touch upon it then. Mr. Marshall had said that it was the practice of the speaker's firm to galvanise the tubes internally and externally. All his firm now did, however, was to galvanise six or eight inches of the lower ends of the tubes. They did not attach so much importance to galvanising the tubes as they had done formerly. Although the boilers in the *Don Carlos* were the largest installation of that type that had been made—and, he thought, the only installation that Messrs. Armstrong had made in this country—still, those boilers had been used by foreign Governments to a large extent. In the Dutch Navy five years ago three cruisers were designed and these boilers were adopted. These vessels passed through their trials very well, and had been in commission for some time, with highly satisfactory results. The Austrian Government recently adopted these boilers in one of their cruisers, and were so highly pleased with them that they telegraphed to his firm congratulating them on the success of the boilers. The installation of the Portuguese cruiser must not be looked upon as standing alone, therefore.

Ice Breakers.

Mr. H. F. Swan read a paper on "Ice Breakers." He said: There can be no doubt that the employment of ice-breakers is destined to become a very important factor in connection with steam navigation generally, and that many ports which formerly were partially, and others entirely, closed during the whole of the winter, will become available for commerce all the year round. It would be impossible, in the limits of a paper of this description, to give many details as regards the construction of such vessels. It will, however, be interesting to the members if I give a few particulars of two vessels built last year, embodying all the latest practice, and which have been at work during the past winter with eminent success. These vessels were the *Sampo*, of 2,000 tons displacement and 3,000 I.H.P., built for the Finnish Government, and the *Ermack*, of 8,000 tons displacement and 10,000 I.H.P., built for the Imperial Russian Government. The *Sampo* has one single propeller aft and another one forward, and her chief dimensions are:—Length, 202 ft.; beam, 43 ft.; depth to upper deck, 29 ft. 5 in. Her bow and stern have considerable overhang, the contour being such as to strike the ice at a very acute angle, so that when the vessel is driven with considerable force, she has a tendency to rise on the ice in a slanting position, which, whilst it conduces to bringing her maximum weight to bear, does so in a manner which mitigates the blow to the vessel herself. The *Ermack* marks an immense stride in the construction of ice-breakers, being fully three times as powerful as any vessel previously constructed; moreover, she has four propellers, three placed aft and one forward. Her principal dimensions are:—Length over all, 305 ft.; beam, 71 ft.; depth to upper deck, 42 ft. 6 in.; the contour of her bow and stern also shows a quite exceptional amount of overhang, and both she and the *Sampo* had their sides inclined outwards at a considerable angle from the vertical, to lessen the strain when the vessels are being nipped in the ice floes. The whole construction of the vessel is exceedingly strong, and she is subdivided into 48 compartments, the water-tightness of which has been tested in the most efficient manner, and, as an example, it may be mentioned that after the vessel was launched, and her engines and boilers fitted on board and all complete, one of the boiler rooms was filled with water to the upper deck, the bulkheads practically showing no deflection. This is probably the most severe test to which the bulkheads of any ship have ever been previously subjected, and as the other parts of the hull are relatively as strong, this gives a good indication of the vessel's solidity. The frames are placed 12 in. apart, and the thickness of the ice belt varies from 1¼ in. at the ends, where most of the ice-breaking is to be done, and is slightly reduced in other parts less exposed to shocks when breaking ice. In ice-breakers generally, it is highly important to have the model of a rounded form, and to have the outside surfaces as smooth as possible, both seams and butts for this reason being flush-plated. It is desirable, also, that the vessels relatively should be short and broad, as this is found to greatly assist their manœuvring in ice, and prevents the broken pieces from clinging to the shell plating. It is also important to have the pumps of enormous power, connected with trimming tanks at the bow and stern, and also at the sides of the ship, so that if the vessel gets caught in the ice, her horizontal plane may be varied in any sense desired, whereby she can the more readily release herself. Experience with the *Sampo* and *Ermack* has shown that pack ice of practically any thickness can be negotiated; and in the case of the latter vessel, she on one occasion encountered a pack which was measured and found to be of a total thickness of 34 ft., 9 ft. being above the level of the field, and through which she successfully forced her way, a feat which would have been quite impossible but for the action of the forward propeller. As regards the propellers themselves, I may mention that we have made them both of bronze and of nickel steel, and have not so far had a broken blade, and this in spite of the fact that on many occasions the engines have brought up "all standing," which, I need hardly say, requires their being designed in all their working parts, both as regards scantlings and surfaces, on a basis greatly in excess of what is usual in machinery for ordinary purposes. Experience with the *Ermack* has shown that she has broken composed ice of 8 ft. 3 in. in thickness, and she has gone through field ice of about 40 in., with 6 in. of snow upon it, at a speed of 2½ to 3 knots; moreover, she has been driven at a speed of about 10 knots through clear ice of 24 in., whilst ice under 18 in. has little effect upon her. It is found that snow has a wonderfully great retarding influence upon an ice-breaker, much more so than a similar thickness of solid ice. Her manœuvring powers are remarkable, seeing that with her helm only, she can turn in a circle of only twice her own length, and her handiness was specially shown when she entered the frozen-up port of Cronstadt on March 16th last, proceeding without stopping through an entrance only 95 ft. wide, and berthing herself alongside the quay without assistance, whereas under ordinary circumstances of navigation in open water, steamers are in the habit of invariably being assisted by tug boats. Her practical utility was not long in being put to the test. Immediately on her arrival, urgent word was received from Revel that a number of steamers were in great jeopardy; she at once proceeded there, and was the means of liberating 33 steamers, of an aggregate value of a million and a-half sterling. She subsequently returned to Cronstadt and St. Petersburg, and was instrumental in relieving and facilitating the entry of some 40 more steamers, several weeks earlier than if they had waited the ordinary opening of the navigation. The above performance is a very conclusive proof of the commercial value of such a vessel. When a passage has once been broken, vessels of ordinary construction can usually follow in the channel thus made without suffering injury; where, however, vessels are intended to work regularly in this way, it would be advisable to give them a little additional strengthening, especially as regards the bow, and as regards the propeller, this had better be of steel somewhat stronger than ordinary practice. It is necessary here to point out that all the foregoing remarks apply to ice-breaking in the Baltic, or where the ice is formed gradually at moderate temperatures, and that the same result could not be looked for in the case of service in the Arctic regions, where the ice is of a much harder and more brittle description, and it probably would not be prudent to have the bow propeller shipped when a vessel is employed among the heavy ice of the Polar Seas. A very important application of ice-breaking steamers is shown in their ability to form connecting links in railway systems in crossing large stretches of water (which it would be either impossible, or too costly to bridge). In conclusion, I can only reiterate my belief that the employment of ice-breaking vessels has not yet reached anything like the importance that it will yet achieve, and that still more important developments in this class of vessel may be expected in the future.

Admiral Makaroff, who was invited by the President to speak on this paper, said the problem which was laid before the shipbuilders with regard to this ice-breaker was very difficult. A ship was wanted which would be able to go into the Neva River, drawing 18 ft. 6 in. That ship was to break the ice in the Baltic during the winter. It was to be used in the same kind of occupation in more northern regions in the summer. The difficulty, however, was not the thing before which the English engineers stopped. There was no ice to break the heart of the English engineer. They found out the way to surmount all these difficulties, and the ship was found to be a success. He was in charge of the trials. They never asked what sort of ice was before them. They asked where the ice was, and then they charged it. The ship had sometimes to go as fast as 15 knots and charge the ice. He wished to draw their attention to the vessel's bulkheads. Bulkheads ought to be really water-tight, and not *soi-disant* water-tight bulkheads. If it happened sometimes that they were not water-tight, he would be very glad to say that it was not the fault of the shipbuilders. They were never asked to build bulkheads which would stand such a pressure. They were asked to build a cheap ship, and the one whose tender was lowest usually got the contract. If, from time to time, ships went to the bottom owing to the bulkheads being imperfect, it was not the shipbuilder's fault exactly, but it was somebody's fault. The other feature in this vessel which he wished to draw attention to was the buffer, which was designed to minimise the force of collision between the *Ermack* and any other steamer. As to whether it was possible to break up the Polar ice, the Baltic ice was from 2 ft. 6 in. to 3 ft. thick. The first ice they encountered in their Polar trial was 7 ft. thick. In the very near future, they hoped to show to what extent it was possible to break through the ice on the way to the North Pole.

Visit to Elswick.

At two o'clock a large party were entertained at luncheon by the Chairman and Directors of Sir W. G. Armstrong, Whitworth & Co., Limited, in the mculd loft.

After lunch, visitors passed to the joiners' shop, where various wood-working machines were seen. A door and stairway on the right lead down across the railway lines to the jetty, off which lies the battleship *Hatsuse*, recently launched for the Japanese Government. Principal dimensions: — Length, 400 ft.; breadth, 76 ft. 6 in.; depth, 43 ft. 11 in.. draught, 27 ft.; displacement, 15,000 tons; I.H.P., 14,500 tons; speed, 18 knots; coal supply, full, 1,690 tons. Armament:—Four 12-in. breech-loading guns; 14 6-in. quick-firing guns; 20 12-pounder quick-firing guns; eight 3-pounder quick-firing guns; four 2½-pounder quick-firing guns; five torpedo-tubes. Armour:—Belt, full length, from 9 in. to 4 in. thick; citadel, 250 ft. in length; 6 in. thick; barbettes, 14 in.; casemates, fronts, 6 in.; casemates, backs, 2 in.; conning tower, 14 in. in thickness.

Visitors then passed under the 100-ton hydraulic sheer legs. On the landward side are the blacksmiths' shop and fitting shop, and alongside the jetty lie two destroyers. Principal dimensions:—Length, 220 ft.; breadth, 20 ft. 6 in.; depth, 13 ft. 6 in.; draught, 5 ft. 6 in.; coal, normal, 45 tons; coal, full, 90 tons. Armament:—Two 18 in. torpedoes; one 12-pounder quick-firing gun; five 6-pounder quick-firing guns; two Maxim quick-firing guns.

The near one—a 30-knot destroyer—is engined by the Wallsend Slipway Co. She was recently launched, and has already begun her trials. The further destroyer, engined by the Parson Marine Steam Turbine Co., with Mr. Parson's well-known turbine motors, is expected to reach a speed of 35 knots.

Moored in the river is the protected cruiser *Fourth of July*. Principal dimensions:—Length, 360 ft.; breadth, 46 ft. 6 in.; draught, mean, 17 ft.; displacement in tons, 4,160. Armament: — Two 8-in quick-firing guns; 10 4·7-in. quick-firing guns; 16 3-pounder quick-firing guns; six 1-pounder quick-firing guns; and five torpedo-tubes.

Visitors then passed along at the head of the building slips.

The first two berths are occupied by Norwegian battleships of great offensive and defensive power. Principal dimensions:—Length, 290 ft.; breadth, 50 ft. 6 in.; depth, 27 ft.; draught, 16 ft. 6 in.; displacement, 3,850 tons; speed, 16 knots; coal supply, normal, 250 tons. Armament:—Two 8·24-in. quick-firing guns, in gunhouses; four 6-in. quick-firing guns, in casemates; two 6-in. quick-firing behind shields; eight 12-pounder; six 3-pounder; two submerged torpedo-tubes; armour belt 6-in. Krupped steel.

Beyond these vessels, and lying off the jetty, is the United States cruiser, *Albany*. Principal dimensions: — Length, 330 ft.; breadth, 43 ft. 9 in.; draught, 16 ft. 10 in.; displacement in tons, about 3.450. Armament:—Six 6-in. quick-firing guns; four 4.7 in. quick-firing guns; 10 6-pounder quick-firing guns; four 1-pounder quick-firing guns; four Maxim guns; two 12-pounder field guns.

Passing round the furnaces, visitors reached the three armour-clad berths, from the first of which the *Hatsuse* had just been launched. On the two adjoining berths lie two Japanese armoured cruisers of the *Asama* type. Principal dimensions:—Length, 400 ft.; breadth, 68 ft. 6 in.; draught, 24 ft. 3 in.; displacement in tons, about 9,800. Armament:—Four 8-in. breech-loading guns, in two barbettes; 14 6-in. quick-firing guns (10 in casemates); 12 12-pounder quick-firing guns; seven 2½-pounder quick-firing guns; four torpedo-tubes, submerged. Armour:—Armour belt, 7 in. and 3½ in.; armour citadel, 5 in.

Steel Works.

Siemens melting furnaces, capable of casting 800 to 1,000 tons per week. Hydraulic forging presses shown at work, the process of casting steel ingots was shown.

Ordnance Department.

The shops in the Ordnance department were taken in the following order:—

No. 18 Shop: Finishing and finished guns, of 12-in., 6 in., and 4·7-in. calibre, and smaller sizes.

Two 6-in. quick-firing guns, mounted on an upper deck carriage and a between deck carriage were shown.

These guns show respectively the system of quick-firing inaugurated by Sir W. G. Armstrong, Whitworth & Co., Limited, in 1887, and one introduced by them in 1893. In the first system the charge is contained in a metal cartridge case fitted with a primer. After the projectile has been inserted into the chamber the cartridge is entered and pushes home the projectile, and thus allows the breech to be closed; the gun is then ready for firing. In the second system the gun is fitted with a modified de Bange obturator, the charge being contained in a silk cloth bag. The projectile is rammed home and the charge inserted. A primer having been inserted in the vent axial, the breech is closed.

In both systems a single movement of a hand lever opens or closes the gun, and in neither case can the gun be fired until the breech is actually closed and locked.

The mountings also show two types. One with a large shield is intended for guns placed in exposed positions on the upper deck of a ship, or for coast defence. The other has a small circular shield, and is intended for guns placed in casemates or between decks.

One man easily trains or elevates the gun and fires when his sights are properly aligned, and four men are sufficient to fight the guns. This is, of course, not counting magazine numbers.

The rapidity of fire with these guns is from eight to nine rounds per minute.

No. 29 Shop: General gun carriage work, electric work, search lights.

The visitors passed to the scene of the recent fire. This fire, one of the largest that has ever occurred in Newcastle. was discovered at 3.10 on the morning of Sunday, June 10th. It was first noticed in a gallery of No. 6 shop,and, spreading with great rapidity, in the course of three hours almost completely destroyed three shops, Nos. 6, 7, and 33. Much has been done since the fire in the way of clearing out the debris and making preparations to rebuild and refit the shops.

No. 17 Shop: Submerged and above-water torpedo-tubes.

No. 28 Shop: Small quick-firing guns.

Over bridge into

No. 12 Shop: General hydraulic fittings for heavy gun mountings.

No. 11 Shop: Machine shop for guns. Turning, boring, and rifling machines.

Engine Works.

Bridge yard, south erecting shop, brass foundry, north erecting shop, brass rolling mill. Steam pumping engines, swing bridges, dock gates, and hydraulic machinery generally.

The firm of Sir W. G. Armstrong, Whitworth & Co., Limited, in addition to the works at Elswick, has branch establishments at Manchester and in Italy, and a second shipyard on the Tyne at Walker. The firm employs more than 25,000 men.

In the evening Sir Andrew and Lady Noble were "At Home" to members of the institution and their ladies at Jesmond Dene House.

The members reassembled on Thursday, July 20th, in the hall of the Literary and Philosophical Society, for the reading and discussion of papers. In the temporary absence of the Earl of Hopetoun, the president of the institution, the chair was occupied by Sir Edward J. Reed.

Nickel v Mild Steel Tubes for Water-Tube Boilers.

Mr. A. F. Yarrow read a paper descriptive of "Some Experiments having reference to the Durability of Water-Tube Boilers," which we publish in full in our present issue.

Sir John Durston, who opened the discussion on the subject, said they must highly appreciate the liberality with which Mr. Yarrow had put the results of his costly experiments at their disposal. It occurred to him that they should have gained a very considerable step in the construction of boilers, water-tube boilers especially, if they could obtain the tubes of a material which, when subjected to such actions as Mr. Yarrow had described, would not commence to deteriorate or oxidise until it had reached a much higher temperature than that at which mild steel would commence to deteriorate. Apparently deterioration of the mild steel and of the nickel steel commenced at about the same temperature, but the experiments carried out by the Admiralty fully confirmed those of Mr. Yarrow, in showing that the deterioration of nickel steel was much slower than that of mild steel. The nickel steel was strongly electro-negative to the mild steel. That action could be reduced by the usual application of zinc plates, and, probably, with experience, obviated. With regard to the variation of expansion of nickel steel and mild steel, that point could be easily met when the two rows of tubes nearest the fire were, as Mr. Marshall suggested, bent tubes. If they put the nickel tubes nearest the fire, the effects of the expansion would not be so serious. The fact of the contraction of the mild steel tubes might explain, in some degree, the tubes coming out of the tube-plates. It was gratifying to know that English firms were taking up the manufacture of nickel steel tubes.

Mr. Riley stated that 10 years ago he endeavoured to attract attention to nickel steel as an alloy, and at that time drew attention to that particular alloy—25 per cent. nickel—on every occasion when that material was being discussed in that institution. He must confess that he was surprised at one of the remarks in the paper that morning, to the effect that the ductility of the alloy might be taken to be almost that of mild steel. That was not at all in accordance with the facts as he had found them. The mechanical tests which he was able to make showed the ductility, as measured by extension, to be at least 50 per cent. more than that of the ordinary mild steel, strength largely above that of mild steel—he meant ultimate breaking strength—and an elastic limit superior to that of mild steel. Nickel steel lent itself more to deformations, such as flanging, drawing, bending, &c. Some two or three years ago, at the spring meeting of that institution, this matter was discussed. At that time the question of tubes came up, and he strongly recommended that attention should be given to that metal for tubes, as likely to remove or overcome a good many difficulties to be met with in mild steel. He was glad that more influential persons had now taken the matter up, and that attention was now to be paid to it.

Mr. Thornycroft thought the institution was very much indebted to Mr. Yarrow for laying before it the results of some experiments which were, at the present time, of great interest. It was well known that the water-tube boiler, which had come into extensive use, was in trouble because of the want of durability of tubes. The first experiment treated gave them an idea of the relative advantage of that alloy, which Mr. Riley brought before them so frequently and persistently, and which now, he hoped, must get the attention which it should have. He thought that the temperatures to which Mr. Yarrow subjected his specimens went beyond what they ought to expect in any well constructed boiler.

Another speaker mentioned that, some years ago, Messrs. Thornycroft sent a torpedo boat across to Denmark. The fresh water was expended simply through the frequency with which it was necessary to blow the fog whistle. The boilers were filled with salt water, but nothing went wrong as a result. On another occasion they sent a boat to South America, and for a long time nothing but salt water was filled into the boilers. Yet in neither case was there any corrosion or salt deposit.

Mr. Sampson remarked that there had been a comparative falling off in the nickel steel tubes when they were submitted to the superheated steam test. Nevertheless, in considering the adoption of tubes of that description, they must look at the matter from a broad standpoint. The superheated steam test represented a state of things which was altogether abnormal. They should look at the mere fact that the nickel steel tube did three times as well as the mild steel. If they applied the nickel steel tube to boilers, the boiler would last as long as the ship. Sir John Durston had stated that the life of the mild steel tubes averaged three years. That would mean that about 25 per cent. of the vessels would always be getting new tubes in—a serious look-out, which was endangering the efficiency of the fleet.

Sir William White said this was peculiarly an engineer's question, but it was one in which all concerned in ship construction must be greatly interested. He had had considerable experience of the use of alloys of nickel and steel in various directions. It had always seemed to him that that application which Mr. Riley had so consistently advocated was one of great promise. He well remembered the attempt, many years ago, to use nickel steel tubes in water-tube boilers. The story had reached him that these nickel steel tubes were ordered with a view to prevent corrosion, that they were very long in being delivered, and that when they did arrive they were exceedingly rusty. Nickel steel was a term which included a good deal, and with nickel at 2s. 6d. per lb. he could quite understand that people did not rush at the idea of using 25 per cent. of nickel in their steel unless there was very good reason for that large expense. A few years ago they were told that there were patents covering everything in the shape of alloy, and that the world's supply of nickel was in the hands of a very few people. These things were not true. If Mr. Yarrow would tell them what was the approximate relative cost of nickel steel and mild steel, he thought it would be seen that they had reached a stage when the alloy was within the reach of practical application. He wished to pay a personal tribute to Mr. Riley in that matter. The first application of nickel steel for armour-plate purposes, on a moderate scale, was made by Mr. Riley. Mr. Hadfield (Sheffield) had written a masterly monograph on all that had been done in the way of the alloys of nickel. If the members read that, they would know almost as much as was to be known on the subject at present. It was impossible to over estimate what they owed to Mr. Yarrow, not only for the extent and elegance of the research which he had brought before them, but for the extreme generosity which had prompted him, at the earliest possible moment, to come forward and give to them, and, through them, to the world, the result of an investigation which he was conscious must have far-reaching effects.

The Chairman wished to modify a statement of Sir William White's, to the effect that abroad they had not made more progress than we had with regard to nickel. The French had made very great progress in the adaptation of that very alloy to a vast number of purposes of domestic utility. He thought that the alloy was superior to silver to look at, and it had the further advantage of enormous strength. Mr. Riley, although for long a voice crying in the wilderness, was the real pioneer in this matter.

Mr. Yarrow, replying, stated that he did not attach great importance to the strength of the nickel steel for water-tubes. The strength was a very small question compared with the durability. Assuming, for argument's sake, that water-tube boilers were worth 20s. per foot of heating surface—his firm did not get that amount—although he believed the Belleville boiler would come out about that—the nickel steel tubes would come out 6s. a foot more than the mild steel, so that they had got to add 30 per cent. to the price of a boiler using nickel steel tubes. As to whether it was worth the additional outlay, that was for the people who bought the boilers to decide. Sir Austin Roberts wrote to his firm that the nickel iron alloys were very peculiar as regarded expansion by heat. An alloy of 25 per cent. of nickel expanded more than ordinary steel, but an alloy of 37 per cent. did not expand at all, showing that the 12 per cent. addition of nickel was quite sufficient to entirely change the character of the alloy.

Large Atlantic Cargo Steamers.

Mr. G. B Hunter next read a paper on "Large Atlantic Cargo Steamers." This we refer to in our Editorial Notes.

Professor Biles stated that he had had some experience in the preparation of designs for large cargo steamers. The reason that cargo steamers had not been larger sooner than they had been was one which was altogether beyond the control of the shipbuilder and the naval architect, and that was the size of the docks in which the ships had to be berthed. He remembered discussing this matter nearly 20 years ago with Captain Watson, the superintendent of the Cunard Line. They went carefully into the subject—just as a matter of interest—and found that the reason was that the docks and the harbours at both ends prevented the larger steamers being built. It was quite a fact to say that as soon as the harbours and docks were ready the shipowners and shipbuilders were quite as ready to put these large ships in. It was not obvious to everyone, perhaps, that large steamers were not always more profitable than smaller ones. With an unlimited volume of trade, the large steamer was inevitably the more profitable. With a limited volume of trade that was not so. The reason why large steamers were more profitable when they could get the limitation of draught removed was that the resistance, or H.P., to a given speed varied as the square of the dimensions, whereas the weight-carrying capacity varied as the cube of the dimensions. He was not quite sure that Mr. Hunter had chosen quite the best depth in proportion to the breadth. One disadvantage was that they did not get as much capacity as they might; another, that they got too much stability when they were going to the westward in ballast; whilst a third was that their steamer was not quite so strong. If a space in a ship was to be for safety and not for cargo carrying, it seemed only fair that that space should not be charged for tonnage. The position of the deep water ballast tanks in Mr. Hunter's ship did not seem to him to be the best position in all respects. He was not sure that tanks immediately forward and aft of the machinery space were not in a better position for the strength of the ship. Great strains came upon a ship when she was on the crest of a wave, and if they they put the weights amidships they reduced the strains. Mr. Hunter had said that until 1895 there were no British cargo steamers of more than 6,500 tons gross register. In 1892 the speaker was connected with the placing of an order of two steamers, both British vessels, which, he thought, were over 9,000 tons. He believed, indeed, that they were nearer 10,000 tons, and they had a carrying capacity of 10,000 tons deadweight. They were ordered in 1892, and finished at about the end of 1893, or the beginning of 1894. He wished to ask Mr. Hunter as to the strength of these large ships forward going to the westward in ballast. With their large flat surfaces they seemed to have a facility for coming to loggerheads with the sea and getting their bottoms staved in through the frames. Had Mr. Hunter had any experience of that sort of thing, and, if so, what precautions did he think it was necessary to take to avoid such an unfortunate state of affairs.

Mr. West, speaking of the position of the deep-water ballast tanks in the typical ship dealt with by the author, said that if the vessel was one of those which Professor Biles had been so successful in designing, with fine lines for a high speed, he would say undoubtedly that the proper place for these tanks was immediately before and abaft the machinery spaces. This, however, was a vessel in which the form was so much swelled out towards the two ends that it was necessary to shift the position. He used the word "necessary" advisedly, because he had seen cases where mischief had undoubtedly arisen from the large weight and water-ballast in the middle of the ship. Whether he would go as far as Mr. Hunter suggested was another matter which would have to be considered on the peculiar merits of each case. Inasmuch as these tanks must have a fore-and-aft division in order to make them seaworthy, that interfered a good deal with the convenience of using them for the stowage of cargo. He assumed that Mr. Hunter would in all cases carry his decks through, so as to give lateral support to the bulkheads. Apart from the shelter deck, they should have sufficient deck to give them girder enough for the length of the ship. Mr. Hunter spoke of an increase of 100 per cent. in the strength of propeller shafts. The speaker would join with Mr. Hunter in every desire to make propeller shafts as strong as possible. Of course, 100 per cent. of strength was a vastly different thing to 100 per cent. of diameter, but still he thought that such an increase was very much larger than was necessary. Where he had had a free hand he took from 30 to 50 per cent. more than Lloyd's rule. There were conditions in nature itself which prevented them from getting the full advantages in dimensions which they would like to have. He was afraid that there were times when no ships at all would be built if the profit which Mr. Hunter had indicated had to be earned. As long as they could construct their engines to drive one propeller without inconveniently increasing the size of the various parts, he believed that for cargo-carrying purposes a single screw had the advantage, because the cost of maintenance was very much less.

Mr. Corry referred to the fact that Professor Biles had taken exception to the position of the deep tanks as proposed by the author, and said he agreed with Mr. West that the tanks thus placed were not so very much out of place in vessels of this class. They could not always put these tanks exactly where they would like. Mr. Hunter had spoken of the construction of these different vessels, and had mentioned some of the weak spots in Lloyd's rules. He (the speaker) could bear out the remark that, to some extent, the rules were not either mechanically or practically what they should be, but the Committee of Lloyd's Register had recently made some modifications. Mr. Hunter had very properly brought before the meeting the question of the breakdown of the tail shafting. That was, without exception, the most critical part of a ship, and the one which required the most careful thought and attention. The speaker did not quite follow Mr. Hunter in his method of curing that. He would rather go in the way of making the shaft of better material, also of increasing the size, but not to the extent of 100 per cent. He would rather improve the material of the shaft.

Colonel Swan said he was quite in accord with the general conclusions of Mr. Hunter, particularly so in reference to the ballasting of large ships. It had always been a surprise to him that shipowners and underwriters had been content for so long to allow vessels to be sent across the Atlantic so insufficiently ballasted. Going back 25 or 30 years, he remembered that they made an attempt to introduce deep ballast tanks. Unfortunately, at that time tanks were not constructed as they ought to have been. Spaces which were used for ballasting got to be called tanks, and were looked upon both by shipowners and people who were supplying cargo as enclosed spaces where the cargo would be subjected to great deterioration. When the tank steamers came to be introduced, and the construction of bulkheads was found to be absolutely tight, a great many of these objections disappeared, and he had no hesitation in saying that there was now no difficulty whatever in constructing bulkheads which were absolutely tight. Water ballast holds could be made as dry and satisfactory as any other holds in the ship.

Mr. T. V. S. Angier, who prefaced his remarks by stating that he was the manager of a fleet of steamers, said that Mr. Hunter had always been in the van among enlightened and progressive shipbuilders in this country, and they owed him a debt of gratitude for teaching them to build the best class of ship for a long lifetime. The points of weakness that were found in vessels after they left the hands of the builders were not always brought to the builders' knowledge, and those who lived by the vessels were the best judges of those weak points. He would mention one of the great points that he had always found a defect in, so far as cargo ships were concerned at any rate. They all knew the terrific rate of corrosion in modern steel ships, and he contended, from his own experience, that the whole life of a ship was a question practically of scraping and painting. There was hardly any ship that he had gone over, inspecting the tanks, bilges, &c., that he had been able to inspect without actual personal risk. Practically, one needed to be a very clever monkey to get all over any ship of the present day. One of the first things that should be looked after was that there should be an absolutely safe and easy access to all the hidden parts of the ship, in order that they might see that these hidden parts were taken care of and kept, as far as possible, free from corrosion, that otherwise must take place if they were neglected. The usual thing was that these parts were neglected. Sailors were not enthusiasts in their work, and did not do more than they could help. It was not at all a trivial question in the life of a ship, and it was one that he wanted to press forward very materially. Water ballast was another great question of the day. No one had mentioned the experiment which had been tried in practically building a second skin for the ship, and utilising the double skin for water ballast; that was too complicated a matter, because it multiplied the difficulty of hidden spaces.

Mr. Leslie Denny, referring to the question of shafting, said he would like to know how many of the 173 vessels disabled in 1898 were disabled due to running across the Atlantic in water ballast. He thought that if the vessels were properly loaded down with ballast the 100 per cent. increased strength would not be required. As to twin-screws, he thought that there was no question of their advantages. He questioned whether so many breakages had occurred with twin-screws as with single propellers.

Mr. J. T. Milton said that, of the 173 vessels reported disabled last year through the failure of their shafting, 89 were classed with Lloyd's register. He could not speak of the rest. When they remembered that a very large proportion of British steamships were classed with Lloyd's, they could not think that 89 out of 173 was an unduly large number to be classed in that society. Of the 89, 26 were in ballast at the time of the disaster, 30 were stated to have been loaded, and there was no record as to the condition of the remaining 33. Out of the 89, 45 were engaged at the time of the casualty, or on their previous voyages in the Atlantic trades. If these vessels were not in ballast at the time of the breakages, it was probable that they were in ballast a short time before, because it was not always easy for Atlantic steamers to get cargo on the outward voyage. Mr. Hunter had stated that it was the bending stress on the shafts that caused the accidents. If they knew what caused the strain they might then learn how best to prevent it. The effect of bending strains on shafts was very much intensified by their irregular sections, the sections necessarily having liners put upon them. Great good would result from having these liners made continuous, and he thought that now that the attention of engineers had been drawn to the subject there was a growing tendency to put continuous liners on the shafts of all new large steamers. When Mr. Hunter suggested that they should make their shafts 100 per cent. stronger, he ought not to have forgotten the fact that the greater proportion of shafts that were running now were running well and giving satisfaction even at the present sizes. There were vessels which, when put into a particular trade or treated in a particular way, gave perfect satisfaction with their shafting. Other vessels, with the same scantlings and the same sizes, gave trouble. It all depended on how they were looked after. It was exceedingly difficult, sometimes, to persuade owners of the importance of drawing their shafts in. He knew of many instances where the shaft had been drawn in and condemned as soon as it was seen. It was the screw shaft which generally failed. The screw shaft was always made a little larger than the other shaft, and it failed because the strain to which it was subjected was an impulsive strain. It was questionable whether it would be wise to largely increase the strength of screw shafting without increasing the strength of the other shafting, which did not give any trouble at present. For a time some friends of his were troubled with broken propeller blades. Each time they renewed the blades they made them stronger. The result was that they did not have any further trouble with the blades, for now all the breakages had been transferred to the screw shafting.

Sir William White remarked that all of them, whether they were interested in merchant ship construction or not, must be deeply interested in the structural arrangements of such ships as these, with their enormous variations in load and condition in different voyages. With reference to the twin-screws, he ventured to ask Mr. Hunter by what process of analysis which satisfied his scientific mind he got out the narrow limits of 5 per cent. between the twin screw and the single screw. Perhaps, if he had put another calculator on to the work he might have found that the 5 per cent. was the other way. As ships grew in size, so the necessity for duplicate propellers was being universally recognised. Mr. Hunter had shown wonderful enterprise when he had attacked, with great daring and originality, the problem of mechanical appliances in the shipyard. He had been under great obligations to Mr. Hunter for information of the most generous character. The speaker was confident that British shipbuilders, if they would hold their own, must be careful to follow on the lines, or on alternative lines, to those on which Mr. Hunter had shown them such a lead.

Mr. Hunter, replying, said he had ventured to calculate upon the shelter deck as giving him some of the longitudinal strength which he required. The reason that he had not put the deep water tanks in the middle of the ship was that he thought the weights would have been too great. He apologised to Professor Biles for having overlooked the two ships which the Professor mentioned, but said their existence had very little or no effect on what he had to say. He did not think that the suggested increase in the strength of shafting—100 per cent.—would be excessive. They were dealing with a great evil. The breakdowns caused a very great loss of property. He did not think that he should be at all exaggerating if he said that these 173 ships had cost something like a quarter of a million of money, consequent on the failure of their propeller shafting. As to the 20 per cent. he had referred to, that only included 5 per cent. profit. If there was not a reasonable prospect of making 5 per cent. out of a ship he would advise the intending purchaser not to have it built.

The last paper, "On Thrust-Block Friction," was not read, owing to want of time. We make some reference to the same in our Editorial Notes.

Thanks to the Reception Committee.

Sir Edward Reed, on rising to perform the concluding portion of the strictly business session, said that Lord Hopetoun had been under considerable pressure in London for some time past, but he had stood nobly by his work until that morning, when considerations of health compelled him to give himself a little rest. They would see him, however, later on. He now asked the members to express their thanks to those who had given them such a splendid reception. He should like to refer, in the first place, to Lord Ravensworth, to whom that Institution would ever be indebted. Earl Ravensworth, by his high position and public services, and his large influence upon naval architecture, both in Parliament and in that Institution, as well as in many other ways, had great claims upon their consideration. It was a satisfaction to the members of the Institution that Lord Ravensworth had been able to attend their meeting that morning, and he would receive their most cordial wishes for his future. The number of public bodies that had contributed to the success of their proceedings was very large, and he included in the vote of thanks the Mayor and Corporation of Newcastle, the Tyne Improvement Commissioners, the Council of the Literary and Philosophical Society, the Sunderland Members, Sir W. G. Armstrong, Whitworth & Co., and the other firms who had permitted the members to visit their establishments. He expressed his pleasure at the considerable attendance of ladies at their meetings, and at the interest they had taken in the papers and in the debates. He was quite satisfied that in future they would have ladies contributing papers at their meetings.

Sir W. H. White seconded the vote of thanks, and expressed the obligation of the Institution to the members of the reception committee and others who had made the arrangements for their enjoyment, and he hoped for their profit also.

The motion was carried with acclamation.

Sir B. C. Browne, President of the North East Coast Institution of Engineers and Shipbuilders, responded. He hoped that 12 years would not be allowed to elapse again before the Institution paid another visit to the district. The Tees and Hartlepool had been disappointed that there had not been time to pay them a visit, and he suggested that, when next the Institution came to this district, the Tees and Hartlepool should be put in the first place, and that the Tyne and Wear should be the second and third lines of hospitality to fall back upon.

Earl Ravensworth, who was invited by Sir Edward Reed to associate himself in the response to the toast, was cordially received. He said it had given him great satisfaction to have been able to attend some of their meetings.

The business proceedings of the meetings then ended.

After the conclusion of the meeting, the members and their friends proceeded to the Corn Exchange, where luncheon had been provided by the Reception Committee.

After partaking of luncheon at the Town Hall the members of the Institution proceeded to the Fish Quay, where steamers where in waiting to take them on an excursion down the river. Those anxious to visit the shipyards went on board the *J. C. Stevenson*, which steamboat, was provided by the Tyne Commissioners, while those who did not desire to go ashore during the journey barked on the *Siren*, provided by the local Reception Committee. The former party was in charge of Mr. G. B. Hunter, and Mr. James Walker, engineer to the Tyne Commissioners, acted as guide to the latter. Those aboard the *J. C. Stevenson* visited the shipyard of Messrs. Swan & Hunter, and on reaching Jarrow, were received by the Mayor (Mr. Archbold) and other members of the Corporation, after which they went ashore to inspect the works of the Palmer Company. Light refreshments were provided by the proprietors of the works visited. The excursionists reached Tynemouth about six, and returned to Newcastle by special train. Though rain began to fall about five o'clock, the outing proved most enjoyable.

Shipbuilding and Dock Building Yards of C. S. Swan & Hunter, Limited, Wallsend-on-Tyne.

The original shipyard was laid out in the year 1872, and is now what is known as the company's West Yard, the area of which is about seven acres. The ground was laid out with five or six slips for building vessels of a small tonnage. In 1874 the business was taken over by the late Mr. C. S. Swan, and it was carried on by him until his death in 1879. At the beginning of the next year, 1880, Mr. G. B. Hunter took over the control of the business, under the style of C. S. Swan & Hunter, since which time the amount of work turned out and the area of the yards have largely increased. At first the ships built were principally small cargo steamers; but gradually the sizes increased and passenger vessels were built and equipped, an interesting vessel of this class being the *Courier*, launched in the summer of 1887, she being a vessel 221 ft. in length between perpendiculars, 30 ft. by 13 ft. 3 in., with single screw, and having what was at that time the high speed of 17½ knots. This vessel is still doing excellent work in her original trade between Melbourne, Victoria, and Geelong.

In the year 1883 it was found necessary to extend the area of the yard, and the ground known as the East Yard was acquired and laid out with shipbuilding machinery of the best type, and it is in this yard that the principal extensions have been made, the workshops, sheds, and machinery having been gradually increased and kept up to date in order to cope with the building of the very largest class of merchant vessels, and it is to successfully undertake the building of this class of vessel that the large ship sheds seen in this yard have been erected. These sheds (designed by Mr. G. B. Hunter and Mr. F. Caws, architect, Sunderland) are each 500 ft. in length, the eastern one being 68 ft. wide in the clear, and the western 71 ft. 6 in. clear in width, the inside height being 83 ft. clear at the fore end, and 80 ft. at the after end. Each shed is provided with two electric travelling cranes with revolving jibs working below the cranes, capable of lifting a weight of three tons, and of travelling at a speed of 300 ft. a minute, and making a complete revolution in a little less than half a minute. On the outside of the east shed is a travelling cantilever crane, also electric, to span the third berth, this crane being designed to lift three tons at any distance up to 65 ft. outwards from the roof, and to travel 500 ft. On each side of each shed two shelves will be noticed, from which vessels are shored instead of carrying the shores to the ground, thus saving a considerable amount of timber and labour. The roof being covered with glass, work can proceed without interruption from bad weather; the advantage of which was during last winter amply demonstrated. The temperature under the sheds is found to be cooler in summer and warmer in winter than outside. The electric current for driving the various motors attached to the cranes and machines is generated in a power-house situated at the central part of the yards, which contains two compound engines, the larger capable of developing 200 H.P. and the smaller 160 H.P. There is also a small vertical compound engine. This engine is used when working overtime and on holidays. These engines drive five large dynamos and one small one, which latter is used for exciting the larger dynamos and also for charging the accumulators which supply the light for the offices. The steam necessary to drive these generating engines is supplied by two Babcock & Wilcox water-tube boilers, and in order to ensure a supply of pure water to these boilers and also to increase the economy of the plant, an atmospheric condenser is fitted on the roof over the boilers.

In 1895 the firm was transformed into a limited liability company, Messrs. G. B. Hunter, J. Price, T. H. Bainbridge, W. Denton, and C. S. Swan being the directors, and the shipyard lying to the west of the original yard, and which was the yard of Messrs. Schlesinger, Davis & Co., was added for the purpose of building the largest class of floating docks, dock gates, and work of that class. The most notable of such docks was the one that was built, launched, and fitted out complete from this yard for the Spanish Government, and towed from the Tyne to Havana in 1897. Other large floating docks have been built for Stettin, Shields, and Wallsend. The area of the various yards is now about 33 acres, with a river frontage of nearly one-third of a mile; and the output has increased, until last year the amount of tonnage launched was 68,696 tons gross register, being the second largest output of that year.

Among other vessels recently built in these yards are the mail steamers *Warrimoo* and *Miowera*, launched in 1892, and which are now running with passengers and mails between Sydney, N.S.W., and Vancouver, B.C., calling *en route* at Brisbane, Fiji, and Honolulu; the *Milwaukee*, *Monarch*, and *Mount Royal*, each of between 11,000 and 12,000 tons deadweight and 18,000 tons cubic capacity, for the Atlantic cargo and cattle service of Messrs. Elder, Dempster & Co., Liverpool; the *Maori*, *Aotea*, and *Tokomaru*, for the Shaw, Savill & Albion Co.'s New Zealand passenger and frozen meat service; and the *Ultonia*, a cargo and passenger steamer of 11,000 tons deadweight capacity, launched last year for the Cunard Company for their Boston service; the *America Maru*, 17½ knots, for the Toyo Kisen Kabushiki Kaisha, of Tokio, Japan, to initiate a new mail and passenger line between San Francisco, Japan, and China; *Saint Andrew*, a four-masted twin-screw steamer, for Messrs. Rankin, Gilmour & Co., Liverpool.

The following vessels are now in progress: The *Kumara*, a large single-screw vessel 440 ft. in length overall, 54 ft. beam, and 32 ft. 10 in. depth, moulded, and built for the Shaw, Savill & Albion Co. Limited, for their New Zealand frozen mutton trade, and which will be capable of carrying 80,000 to 100,000 frozen sheep on each trip. This vessel is at present in Hartlepool, having her machinery fitted on board. On the west berth of the west yard is a vessel for the Atlantic service of Messrs. Elder, Dempster & Co., Liverpool, 348 ft. by 48 ft. by 26 ft. 10 in.; carrying capacity, 5,850 tons deadweight. In the next berth is a steamer 392 ft. by 46 ft. 3 in. by 31 ft., for Messrs. Rankin, Gilmour & Co., of Liverpool, 6,800 tons deadweight, her intended trade being between Antwerp and Newport News. On the eastern berth in this yard is a 5,500 tons deadweight tank steamer for carrying petroleum in bulk, 355 ft. by 47 ft. by 29 ft., building for Messrs. C. T. Bowring & Co., of Liverpool.

In the east yard under the west shed a large twin vessel is being laid down, 483 ft. by 56 ft. by 34 ft. 10 in., to carry about 10,700 tons deadweight and 18,000 tons cubic capacity, to steam 12 knots average in the Atlantic Line of Messrs. Elder, Dempster & Co. Under the eastern shed is the largest vessel the company has yet built and also the largest ever built on this coast. This is a passenger and cargo liner for the Cunard Co., and is 600 ft. long over all, 64 ft. 6 in. beam and 49 ft. 6 in. deep to the shelter deck. She is intended for their New York and Liverpool service, and will carry 150 first-class passengers, 1,000 steerage passengers, half of which will be provided with two, four, and six-berthed state rooms. At the after ends, stalls will be provided for 800 head of cattle and 80 horses. The average speed at sea is intended to be 15 knots, the power being obtained from two sets of quadruple expansion balanced engines working twin-screws. On the easternmost berth is a vessel, 472 ft. by 52 ft. by 34 ft. 2 in., for Messrs. Thos. Wilson, Sons & Co., of Hull, which is also a twin-screw vessel and for the Atlantic cattle trade.

Palmers' Shipbuilding and Iron Company, Limited, Jarrow-on-Tyne.

Evidence that the district of the Tyne was from an early period a highly important shipbuilding centre, is afforded by the fact that, writing more than a century and a half ago, Defoe, in speaking of the Tyne, says: "They build ships here to perfection, I mean as to strength and firmness, and to bear the sea." Since this was written the world has moved at a marvellous pace, and in shipbuilding, more than in any other branch of national industry, progress has been made by leaps and bounds, and the vessels of to-day have no more resemblance to those of Defoe's days than has the "Flying Scotchman" express train in common with the cumbrous vehicles in use for travelling at the time when George II. ascended the throne—a date contemporary with that of the publication of Defoe's work from which the above sentence is quoted. In one respect, however, things remain now as they apparently were then. The river Tyne is still unequalled for its shipbuilding industry, and neither on the Thames nor the Clyde is to be found a private shipbuilding yard which at all approaches in extent or resources the establishment of Palmers' Shipbuilding and Iron Co., Limited. to which we are about to draw attention.

Sir Charles Mark Palmer, Bart, M.P., the founder of the company, and its chairman until 1893, when he retired, has played a leading part in the introduction of iron shipbuilding. About the year 1850 the carriage of coal by railway began seriously to affect the sale of North country coal in the London market, and it became, therefore, essential in the interest of coal owners to devise some means by which the staple produce of the district could be conveyed to London in an expeditious, regular, and economical manner. To accomplish this object was the problem which Sir (then Mr.) Charles Palmer set himself, and with that end in view he designed an iron screw steamer, the *John Bowes*, which had a carrying capacity of 650 tons, and was capable of an average speed of nine miles per hour. To the success of this experiment, more than to anything else, is due the truly marvellous development of the shipbuilding industry on the Tyne as well as elsewhere. The new departure met, originally, with much opposition; Mr. Palmer, however, felt confident of the result, and time has amply demonstrated the soundness of his theories and the wisdom of his plan. Nay, more, as illustrating the quality of the material and the excellence of the workmanship, embodied even in those early days in the vessels produced by the firm, let it be placed upon record that the *John Bowes* is still doing as good service as it did when first launched, and yet over forty-four years have elapsed! Many other instances of a like character might be adduced redounding equally to the credit of the company.

The shipbuilding yard was established in 1851, down to which time Jarrow was a mere pitmen's village, inhabited by the small number of persons who were employed at a colliery in the neighbourhood. This colliery has long since been exhausted and filled up; and had it not been for Messrs.

Palmers' wisely directed enterprise, Jarrow would probably to-day have no existence in the commercial annals of this country. As it is, the place has become a flourishing town, with a population of over 40,000, and no one can pass through its streets without being impressed with the signs of prosperity which are manifested on every hand, but without acknowledging that Messrs. Palmer, by establishing here their works of unequalled extent, have conferred lasting blessings—physical and social—upon the working population of the Tyne district. What—looking at it from a broader point of view—their unaided efforts have done for the nation in enabling us to maintain our prestige as the greatest and best shipbuilders in the world, and in increasing our means of defence by supplying to the Navy some of its finest and most powerful ironclads, it is the object of the following notes to bring into prominence.

The company's works cover an area of nearly 100 acres, and have a river frontage of 4,000 ft., while the number of building slips available is fifteen. Accommodation for repairing purposes is also provided on a large scale, including, as it does, a graving dock, 440 ft. long by 70 ft. wide, and a slipway, 600 ft. long, worked by hydraulic lifting gear. To enable the reader to form some faint notion of what is implied by Palmers' Shipbuilding and Iron Works, let us state that they include within themselves the entire range of operations, from the smelting of the ironstone to the complete equipment of iron or steel vessels of all sizes.

Each of the five blast furnaces in operation is about 85 ft. high, of 24 ft. diameter at the boshes, and from 8½ ft. to 10 ft. in the hearth. They are capable of producing together over 4,000 tons of pig-iron per week, more than one-half of which quantity is used in the company's works. Taking the average, the production of pig-iron amounts to nearly 250,000 tons per annum, and that of finished iron and steel to 100,000 tons. The blast is heated to about 1,500 degs. Fahr. in "Whitwell" hot-air firebrick stoves, and there are 18 kilns available for calcining the Cleveland ironstone.

In connection with the steel works and rolling mills, which are of the most modern character, there are two forge engines with 36-in. cylinders, one of 4 ft and the other of 5 ft. stroke, each driving a roll train and four pairs of 22 in. rolls. Besides these, there are two plate mills and 10 mill furnaces, with an output of about 1,200 tons of finished boiler and ship plates weekly. Each mill has two pairs of 24 in. rolls, reversed by clutch and crabs. They have further a bar mill, with two pairs of rolls, driven by a 24 in. cylinder, which produces weekly 120 tons. A fourth mill, with four pair of rolls, driven by two 30 in. cylinders, with 4 ft. stroke, produces about 300 tons of plates per week. In addition to the above, there is a large angle and bar mill, driven by a single engine having a 36 in. cylinder and a 4 ft. stroke, which is capable of rolling the very largest angles used in the trade; and there is also a sheet mill in the forge. Attached to the rolling mills are shears, circular saws, punching and straightening presses, and other appliances for the construction of iron and steel ships built on the river frontage of the Jarrow works.

Prodigious as are the foregoing figures, they only relate to one section of this immense shipbuilding yard. The adjoining department is devoted to the production of engines, and its manufacturing capacity may be judged from the fact that here can be finished from 30 to 40 pairs of marine engines, with their boilers, in one year. This department, too, we may add, produces its own iron and brass castings and forgings, and is thus altogether self-contained. In the boiler shops vertical rolls for rolling long boiler shell plates were first used, and the original rolls may be still seen in operation. Allusion has been made to the productive capacity of this portion of the establishment; and that what they have said on this head is not mere theoretical assumption may be inferred from the fact that as many as 36 pairs of engines of 7,300 nominal, and 39,240 I.H.P. have been turned out in one year.

Next in order for mention comes the shipbuilding department proper, which occupies the east end of the company's works. It contains a large graving-dock capable of accommodating vessels up to 440 ft. long, and also, amongst others, a very fine patent slip, lately fitted with hydraulic hauling gear. The building slips are suitable for every kind of vessel up to 500 ft. in length, and together with those in the Howden branch of the works, on the opposite side of the river, are capable of launching 70,000 tons of shipping annually.

Let us adduce a few more figures which will demonstrate the unequalled productive capacity of Messrs. Palmer as shipbuilders. In 1881 the output amounted to 48,000 tons of shipping. During the following year 29 vessels were built, of an aggregate tonnage of 61,489 tons, or an average of 1,183 tons per week. Even these very high figures have, however, since been exceeded, the total output in the year 1889 having been 28 vessels, representing a gross register tonnage of 64,669 tons, or the enormous average per week of about 1,347 tons. All these ships, be it remembered, have also been fitted with engines and boilers built at the works. The vessels at present in course of construction, or on order, consist of several very large passenger and cargo steamers of nearly 11,000 tons deadweight, a first-class battleship, and several torpedo boat destroyers for the British Government, which are to have a speed of 30 knots. They have quite recently delivered to our Admiralty nine vessels of this high-class, as well as two cruisers, all of which have given the greatest satisfaction in their official steam trials. The record of the Palmer Co. in naval work is noteworthy, inasmuch as they have built 50 war vessels for the English Navy, among which is to be found every type of fighting ship, including the two first-class battleships, *Resolution* and *Revenge*, built under the Naval Defence Act of 1889, and the last of which was launched in November, 1892,, and delivered complete in October, 1893, being, we believe, the shortest time in which a battleship of her size has been completed.

It may be well to mention, in conclusion, that the company under notice stands out pre-eminent from all its competitors. The Jarrow Works are the largest and busiest of any private shipbuilding yard in existence, and although some of our own Government dockyards are larger in area, they can none of them—neither Chatham, Devonport, nor even Portsmouth—compare with the works in question for the extent of the operations carried on.

In the evening, at the Hancock Museum, the members of the Institute of Naval Architects were entertained at a soirée by the local Reception Committee. There was a large and brilliant attendance, against which the unfavourable weather seemed hardly to have militated. The main reception room presented a most animated and picturesque appearance, the bright dresses worn by the ladies lighting up the sombre hall with a singularly pleasing effect. Nearly all the local members were present, with many of the visitors from a distance.

The members of the Institution devoted Friday, July 21st, to an excursion to Sunderland for the purpose of inspecting the pier works and various shipbuilding and engineering establishments on the Weir. A special train left Newcastle at 9.45 a.m. and arrived at Monkwearmouth Station, Sunderland, shortly after 10 o'clock. The Mayor of Sunderland (Alderman Bruce) and the Sunderland members of the reception committee had assembled at the station to receive the members of the Institution. The party, numbering 200, proceeded by tram-cars to the Roker Pier. The visitors were there received by Sir James Laing, chairman of the River Weir Commissioners, Sir Hedworth Williamson, Messrs. G. R. Booth, R. M. Hudson, R. H. Gayner, C. H. Dodds (traffic manager), H. H. Wake (engineer), and J. G Morris (clerk to the River Weir Commissioners).

At the entrance to the North Pier there was an interesting display of models. That which attracted most attention was a very perfect representation of the mammoth crane, showing the manner of the construction of the pier, which was also illustrated by a coloured diagram showing a section of the work. There was also a model of the lighthouse which will be erected on the roundhead of the Roker Pier on completion, and of the concrete barge. showing the disposition of the concrete bags—the long ones being alternated with short ones. The party then turned towards the pier, a large number being carried along on the car A large red granite faced block, weighing some 50 tons, had been taken to the end of the pier, it having been arranged that this huge block should be formally laid by Lord Hopetoun. In the centre was a grey granite block in which the words had been carved, "Hopetoun, 21·9·99."

Mr. Wake, the engineer to the Commissioners, gave a brief account of the new works, which, he said, consisted of two harbour piers. The Roker Pier foundation-stone was laid in 1885, on September 14th, by Sir James Laing. The South Pier foundation-blocks were laid in 1892 by Mr. R. M. Hudson and Mr. Robert Thompson, chairman of the Works Committee. Since then different blocks had been laid by various notable personages. Enclosed in the docks was a water area of 50½ acres, and between the piers there was an area of 153 acres. There were three miles of quayage round their works, and they had a lock 480 ft. long by 90 ft. wide, with 65 ft. gateways. The amount of coal shipped from the port last year was 4½ million tons. The Roker Pier was 2,790 ft. long, and they had only 38 ft. to finish until the roundhead was ready for completion. This would be completed by a steel or iron caisson loaded with concrete, and when placed in position would contain a mass of 13,000 tons to low-water mark; the roundhead and lighthouse when completed would weigh 28,800 tons. This work was expected to be completed next year. When the piers were finished they would have smooth water in all weathers inside. The foundation of the piers was composed of bags of concrete lowered into *situ*, the structure above being granite-faced blocks weighing from 43 to 51 tons. Before the piers were started they had only 3 ft. to 4 ft. of water on the bar, but they had gained some 12 ft. on this, which was maintained without dredging, and by the scour of the tide only. This showed that they were proceeding on right lines, or at least they believed so. The length of the South Pier was 2,884 ft., of which 1,763 were completed. He mentioned that the spray had been 107 ft. above high water, when heavy seas prevailed, yet it was satisfactory to note that they had not lost a life, had never killed a man, and had not lost a piece of their work.

The Earl of Hopetoun then laid the large block that had previously been brought from the shore end of the pier, and declared it well and truly laid. He said he was very proud that the name of the president of the Institution of Naval Architects should be handed down to posterity on such a fine work as that. He thought they would agree with him in taking that opportunity of thanking their hosts for their kindness in showing them so much to interest them. He wished good luck to the port of Sunderland, and hoped they would reap the reward of their pluck at having spent so much money.

The visitors then left the pier, and a number proceeded to Messrs. J. L. Thompson's shipyard, while others went to Messrs. Dickinson's engine works, By far the greater number, however, proceeded along the pier works to the dock basin, where the steamboat *Siren* awaited their pleasure. A short trip to sea ensued, and proved thoroughly enjoyable. Refreshments were served on board, and the proceedings were most pleasant. The vessel returned to the port by the south entrance, and at once proceeded to the Havelock warehouse, where luncheon was served, the visitors being the guests of the reception committee.

The party again boarded the *Siren*, and visited the North-Eastern Marine Engineering Works, Messrs. George Clark's, engineers, and the shipyards of Messrs. Bartram & Sons, the Sunderland Shipbuilding Co., Sir James Laing (Deptford), Messrs. Short Bros., and also Messrs. Doxford & Sons' shipbuilding and engineering establishment, where they went over a new "turret" steamer recently launched for the Clan Line, of Glasgow, in which great interest was evinced, many of the members not having previously seen a vessel of this construction. The process of "joggling" ships' plates was also watched, and then an adjournment was made to the offices, the model hall of which was greatly admired. After light refreshments had been partaken of here the visitors entrained for Newcastle, having spent an exceedingly pleasant day.

Visit to Cragside.

No more pleasing termination to the summer meetings of the Institution of Naval Architects could have been arranged than the excursion to Cragside, which took place on Saturday, July 22nd. Throughout the week there was a happy combination of pleasure with business, and the members made many interesting visits to places on Tyneside and Wearside; but it was the general feeling that the earlier expeditions did not, in any instance, prove so wholly enjoyable as that which, at the kind invitation of Lord Armstrong, was made to his beautiful home at Cragside. The party, which numbered over 400, a goodly proportion being ladies, travelled by saloon carriages to Rothbury, two special trains being required for the purpose. Newcastle was left shortly after 9 o'clock, the journey to Rothbury occupying about an hour and a-half. Mr. W. A. Watson-Armstrong kindly came to the railway station to welcome the visitors, and a large number of conveyances were in waiting to convey them to Cragside. Many people, however, preferred to cover the distance on foot, and as the weather was all that one could wish for, the walk proved most enjoyable.

Lord Armstrong's picturesque mansion, Cragside, was begun in 1863, designed by Norman Shaw, R.A., is built in a composite style of architecture, partly Gothic and partly Elizabethan. The house forms a strikingly effective picture when contrasted with the rugged scenery in the background. Lord Armstrong, unfortunately, was not in a state of health which would warrant him undergoing the excitement of meeting so large a number of visitors, although his lordship had looked forward to the event with interest, and would most gladly have discharged the duties of host had his health permitted him to do so.

The visitors were entertained to luncheon in a huge marquee erected on the grounds This terminated the proceedings, and the members and their friends left Rothbury shortly after 2 p.m., reaching Newcastle between four and five. The excursion was a most enjoyable termination to a very successful meeting. Thanks are due to the Reception Committee, President, and Secretary of the Institution, also A. J. Cochrane, Esq., and John Duckitt, Esq., joint Hon. Secretaries.

SOME EXPERIMENTS HAVING REFERENCE TO THE DURABILITY OF WATER-TUBE BOILERS.*

By A. F. Yarrow, Esq., Vice-President.

FEELING sure that anything which may tend to increase the durability of water-tube boilers will interest the members of our institution, I have much pleasure in laying before you the results of some experiments which we have recently carried out with a view to ascertain the comparative merits of nickel steel tubes and tubes of mild steel, such as have hitherto been used in water-tube boilers.

The nickel steel to which this paper refers is an alloy, having from 20 to 25 per cent. of nickel, and in these experiments we have tried to repeat as nearly as possible the worst conditions as regards wear and tear to which tubes in water-tube boilers are subjected.

The deterioration of the tubes is probably owing—

(1) To the action of acids in the water, due to grease, which, in spite of every precaution, finds its way into the boiler.

(2) To the tubes becoming overheated and oxidising on the outside, through contact with the hot gases when passing from the furnace to the uptake.

(3) To the action of the steam, which, if superheated, decomposes, causing deterioration on the inside of the tubes.

The last two conditions occur when the tubes, from defective circulation, shortness of water, or from the collection of scale, become overheated.

Table I. records what we have termed the "Corrosion Test" It will be seen that the piece of nickel steel tube A was compared with the piece of mild steel tube B, the original weights of which were 190 and 186 grammes respectively. Both the tubes were immersed in the same dilute solution of hydrochloric acid for various periods, as indicated. The duration of the tests varied, as shown, from 21 to 168 hours, making a total number of hours for all the trials of 533. The ultimate loss of weight in the nickel steel tube was 5 grammes, and in the mild steel tube 98 grammes. It will be seen that the original weights of the two specimens in this case did not accurately agree; but in the second trial, E and F, the tubes were of the same original weight, namely, 188 grammes each. The ultimate loss of weight was found to be 7 grammes with the nickel steel tube E, and 100 grammes with the mild steel tube F.

The upshot of the above tests, it will be seen, is that the loss of weight in the first series of tests of the nickel steel tube amounted to 5 grammes, being 2·63 per cent., and in the mild steel tube to 98 grammes, being 52·68 per cent. In the second series of experiments the loss of weight of the nickel steel tube was 7 grammes, being 3·72 per cent., and the mild steel tube 100 grammes, being 53·19 per cent. The average loss of weight in the mild steel tube was therefore 16½ times what it was in the nickel steel tube.

The tubes as they appeared on the termination of this experiment are shown on Plate I.

It may be contended that the relative corrosion of the two specimens when using dilute hydrochloric acid does not correspond with what it would be with such acids as are present in

---

*[Read at the Summer Meeting of the Fortieth Session of the Institution of Naval Architects, July 20th, 1899, Sir Edward Reed in the chair.]

TABLE I.—CORROSION TEST.

Experiments to Ascertain the Effects of Acid on Nickel Steel and Mild Steel Tubes.

Marks and Material.		Original Weight in Grammes.	Two Parts Water. One Part Hydrochloric Acid.									Total Loss in Weight during 338 Hours.
			Duration of Immersion in Hours.									
			21	64	44	92	168	72	24	24	24	
			Weights in Grammes.									
Nickel Steel ..	A. N.S.	190	190	189	189	188	186	186	185	185	185	5
Mild Steel....	B. S.	186	184	173	166	140	101	98	94	91	88	98
Nickel Steel ..	E. N.S.	188	188	187	187	186	183	182	181	181	181	7
Mild Steel....	F. S.	188	187	173	162	137	112	95	92	90	88	100

TABLE II.—FIRE TEST.

Experiments to Ascertain the Effects of Fire on Nickel Steel and Mild Steel Tubes.

Marks and Materials.		Original Weight in Grammes.	Heated Blood Red for Thirty Minutes, and allowed to Cool.	Heated Bright Red and Cooled in Water.	Scale Removed.	Heated Straw Colour for One Hour and allowed to Cool.	Tubes partly Flattened to remove Scale.	Heated Straw Colour for One Hour and allowed to Cool. Scale Removed.	Heated Straw Colour for One Hour, and allowed to Cool. Scale Removed.	Heated Straw Colour for One Hour, and allowed to Cool.	Scale Removed.	Total Loss in Weight in Grammes.
			Weights in Grammes.									
Nickel Steel ..	C. N.S.	192	192	190	190	171	170	159	151	145	145	47
Mild Steel ..	D. S.	185	184	183	180	130	120	94	68	42	40	145
Nickel Steel ..	G. N.S.	188	188	186	186	172	172	153	142	139	136	52
Mild Steel ..	H. S.	188	188	186	184	147	145	89	58	51	45	143

boilers under working conditions, but it is not unreasonable to suppose that it may serve as a guide.

We will now turn to Table II., which records what we have termed the "Fire Test." This was conducted in the following way:—Two tubes were placed side by side in a small brick furnace, where they were heated to the same extent, and in every way were practically under the same conditions. The loss of weight of each tube due to the oxidation after they had been in a very heated state is indicated by the weights given. It will be seen that the original weight of the nickel steel tube C was 192 grammes, and the mild steel tube D was 185 grammes. The total loss of weight in this series of tests was, in the case of the nickel steel tube, 47 grammes, or 24·47 per cent., and of the mild steel tube 145 grammes, or 78·37 per cent. In this case also the original weights of the two pieces of tube were not exactly the same, and we therefore repeated the experiments, as shown by G and H, in which the weights of the two tubes were identical, namely, 188 grammes, and the loss of weight was found in the nickel steel tube to be 52 grammes, or 27·66 per cent., and of the mild steel tube 143 grammes, or 76·06 per cent. The average loss in weight in the mild steel tube was, therefore, 2·9 times what it was in the nickel steel tube.

These tubes as they appeared on the termination of this experiment are shown on Plate I.

These results were submitted to Sir John Durston, and he pointed out that the experiments did not accurately conform to all the conditions under which boilers are worked, inasmuch as the tubes, in the case of a boiler when the heating surfaces are not in close contact with the water inside, are subject not only to the action of the gases on the outside, but to that of the superheated steam on the inside. The correctness of this view is unquestionable, and we consequently tested two tubes having a length of 1 ft. 8⅝ in. by a diameter of 1 in. outside by 14 L.S.G. This experiment we termed the "Superheated Steam Test," and I would now beg reference to Plate II., Fig. 1. The experiment was carried out in the following manner:—Two tubes, one of nickel steel N, and the other of mild steel O, were placed side by side in a small brick furnace; at one end of each tube steam was supplied at 60 lbs. pressure, it being allowed to issue slowly from the opposite end of each tube, thus ensuring the steam being highly superheated. The result of this experiment is shown on the diagram. The original weight of each tube was 612 grammes. After the experiment had proceeded ten hours, it was stopped, as the mild steel tube O gave out, steam issuing from the defective place. The loss of weight in the case of the nickel steel tube N was 12·7 grammes, and in that of the mild steel tube O, 85·2 grammes. Deterioration in this case is due partly to the action of the steam inside the tube, and partly to that of the gases outside.

The loss of weight of a boiler tube from deterioration at the commencement of its life being much less rapid than towards the end of its life, therefore the loss of weight cannot be considered as a quantitative guide for durability, and we continued the superheated steam test as follows:—After the mild steel tube O had burnt through and allowed the steam to escape, we replaced it by another similar mild steel tube P, corresponding to what would be done in retubing a boiler. The experiment was then continued, and it was found this second mild steel tube

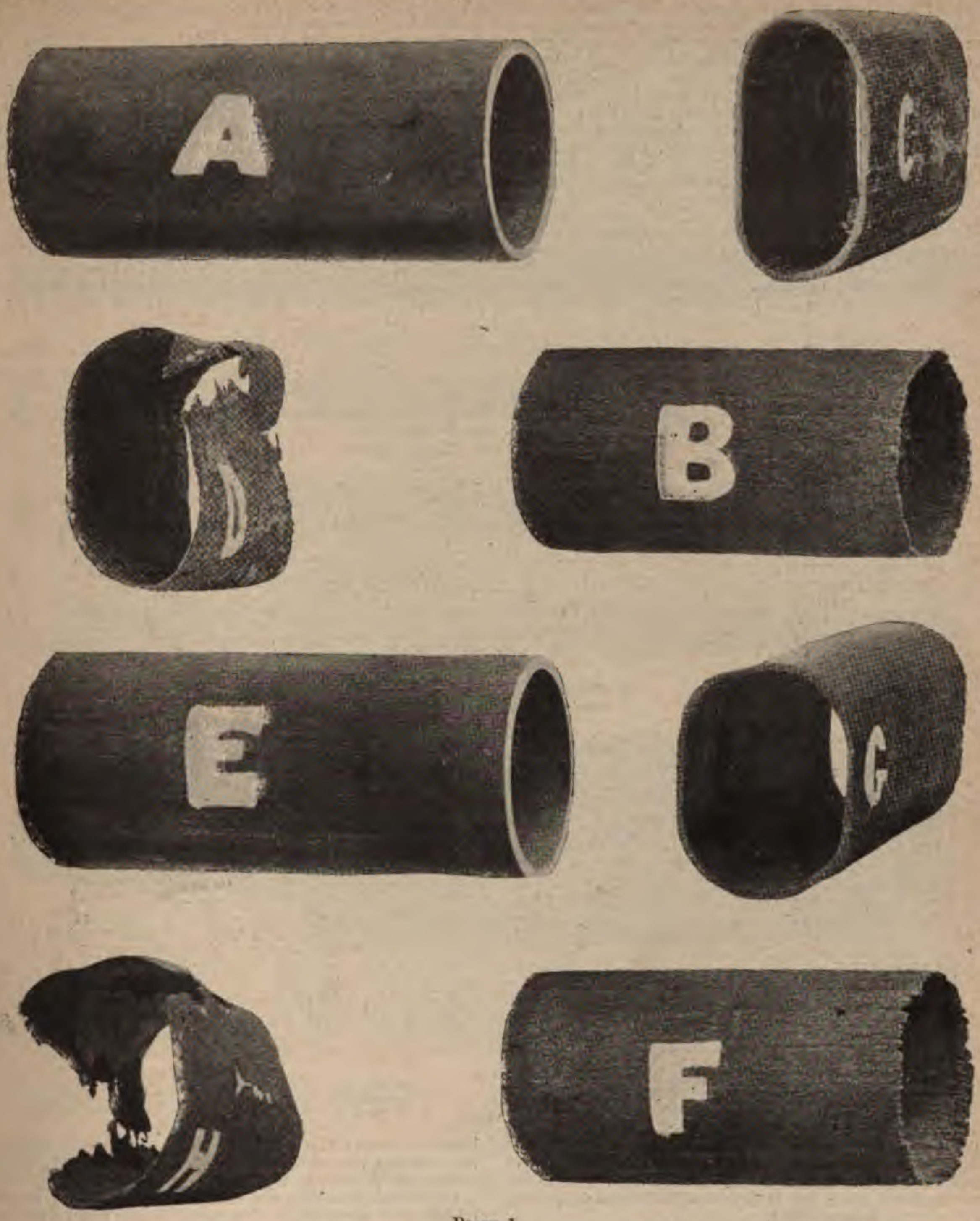


PLATE 1.

gave way and the steam burst through after eight hours, the nickel steel tube still remaining intact. We then substituted this burnt mild steel tube by another tube R, and we found that after three hours the nickel steel tube gave out.

Every two hours during these experiments the position of the tubes was changed about, not only end for end, but side for side, so as to ensure that both tubes were subjected to the same conditions.

The tubes as they appeared at the termination of this experiment are shown on Plate III.

It will be seen from this that the durability of the nickel steel tube corresponded to 21 hours, and the mean durability of the first two mild steel tubes to nine hours. I think, therefore, there is a reasonable probability that from this cause of deterioration a boiler would require to be retubed 2⅓ times as often with mild steel tubes as it would with nickel steel tubes.

In the foregoing experiments the tubes were ungalvanised. Had the mild steel tubes been galvanised there would have been a small addition to their durability, the extent of which is a matter of doubt.

We then made some trials with a view to ascertain the relative expansion by heat of the two materials. Two tubes were taken, 22 in. long, 1 in. in diameter, No. 16 L.S.G. They were inserted in a large tube and heated gradually up to a dull red for about three-fifths of their length. The tubes were fastened together at one end and projected freely and independently beyond the furnace at the other. A record of the expansion of each of the tubes was made by means of a trammel, and their expansion accurately determined. It was found that the expansion of the nickel steel tube was considerably greater than that of the mild steel tube. Plate II., Fig. 2, shows the gradual increase of length during the process of heating up, which occupied 330 seconds, and it was found that the relative expansion was approximately as 3 to 4, the nickel steel expanding the most. The object of this experiment was to ascertain whether there was sufficient difference in the expansion and contraction of the two materials to cause trouble when nickel steel tubes are placed within a group of tubes of mild steel. The result points to possible risk in this direction, and, should it be desired to place nickel steel tubes in those parts of the boiler where deterioration proceeds with the greatest rapidity, and mild steel tubes elsewhere, this variation of expansion should be borne in mind. I am not prepared to say it is a source of risk; but it is one of those practical points which must not be overlooked.

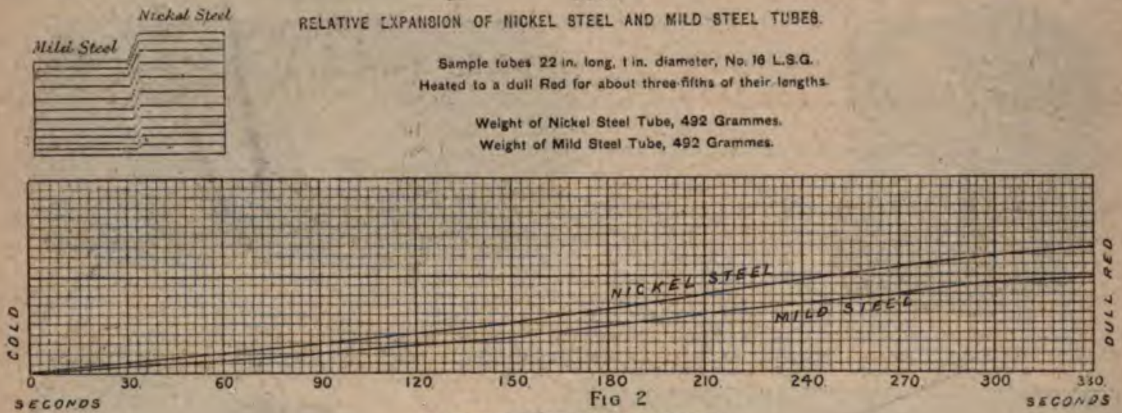
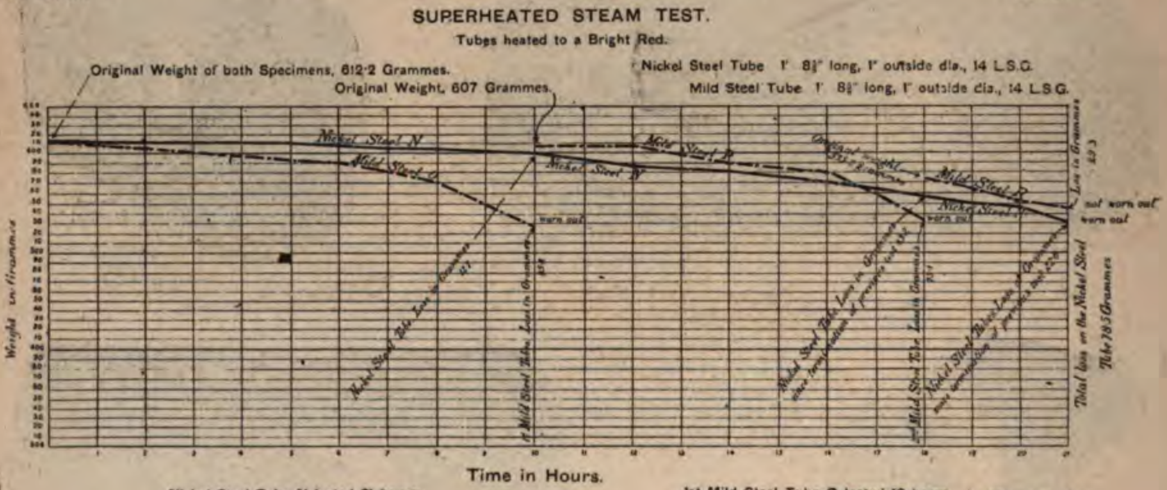


Fig 2



Nickel Steel Tube N lasted 21 hours.

1st Mild Steel Tube O lasted 10 hours
2nd Mild Steel Tube P lasted 8 hours } Mean 9 hours.

Fig 1

Plate 2.

All the specimens that I have referred to are here for your inspection, and I would remark that the tubes corresponding to Tables I. and II. were not of quite the same length, the nickel steel tubes being in all cases somewhat longer than the mild steel tubes, and therefore so far as this difference in size is concerned it was unfavourable to the nickel steel tubes, which exposed a larger surface to deterioration.

To illustrate the suitability of nickel steel from a mechanical point of view, I have brought a few specimens (see Plate IV., also No. 1, Plate III.). Nos. 1 to 6 illustrate its ductility, *which* is almost equal to that obtainable with mild steel. I would submit that the ductility of these samples is amply sufficient for all practical purposes. Nickel steel is considerably tougher in working than mild steel; it involves more labour, and causes greater wear and tear of the tools employed in expanding and bell-mouthing, to which latter operation we have always attached the highest importance. The ductility does not seem to be impaired by sudden changes of temperature, as shown by specimens Nos. 7 and 8, these specimens having been bent after being heated and chilled.

As regards cost, sufficient has not yet been done to know what the probable ultimate price may be; but, doubtless, it will be reduced from what it now is, if tubes of this alloy are introduced. Even at the present stage, judging from the experiments described, it is not unreasonable to expect that the longer life of the nickel steel will prove fully proportionate to its higher price, if the cost of the more frequent replacing of the mild steel tubes is taken into account; and if this surmise be correct, clearly a decided gain would be obtained by the greater trustworthiness of boilers with nickel steel tubes, and by avoiding the frequent loss of time involved in retubing operations, during which period the boiler is laid up.

I would observe that we have tried experiments as to the comparative durability of nickel steel having small percentages of nickel, say, up to 5 per cent., and have found that a very slight increase of durability is obtained by such alloys, but not sufficient to render them of any practical value for boiler tubes.

Summary.

From the foregoing experiments, I think it not unreasonable to assume that nickel steel (20 to 25 per cent. nickel) boiler tubes will have as regards acid corrosion, a vastly longer life than those of mild steel, and, as regards deterioration from the action of heated gases or steam, at least twice the durabilty of mild steel.

Before concluding, I should like to mention that these experiments have been carried out in consequence of our attention having been drawn to the probable advantage of nickel steel tubes by Mr. Andreæ, the engineer-in-chief of the Dutch Navy.

In these remarks only a few points have been touched upon in relation to nickel steel, but those members who may be desirous of looking further into the matter I would refer to the valuable paper recently read by Mr. Hadfield before the Institution of Civil Engineers.

I should also like to add that these experiments have been carried out under the direct supervision of my friend Mr. Crush, to whom I am much indebted for the care he has given to this investigation.

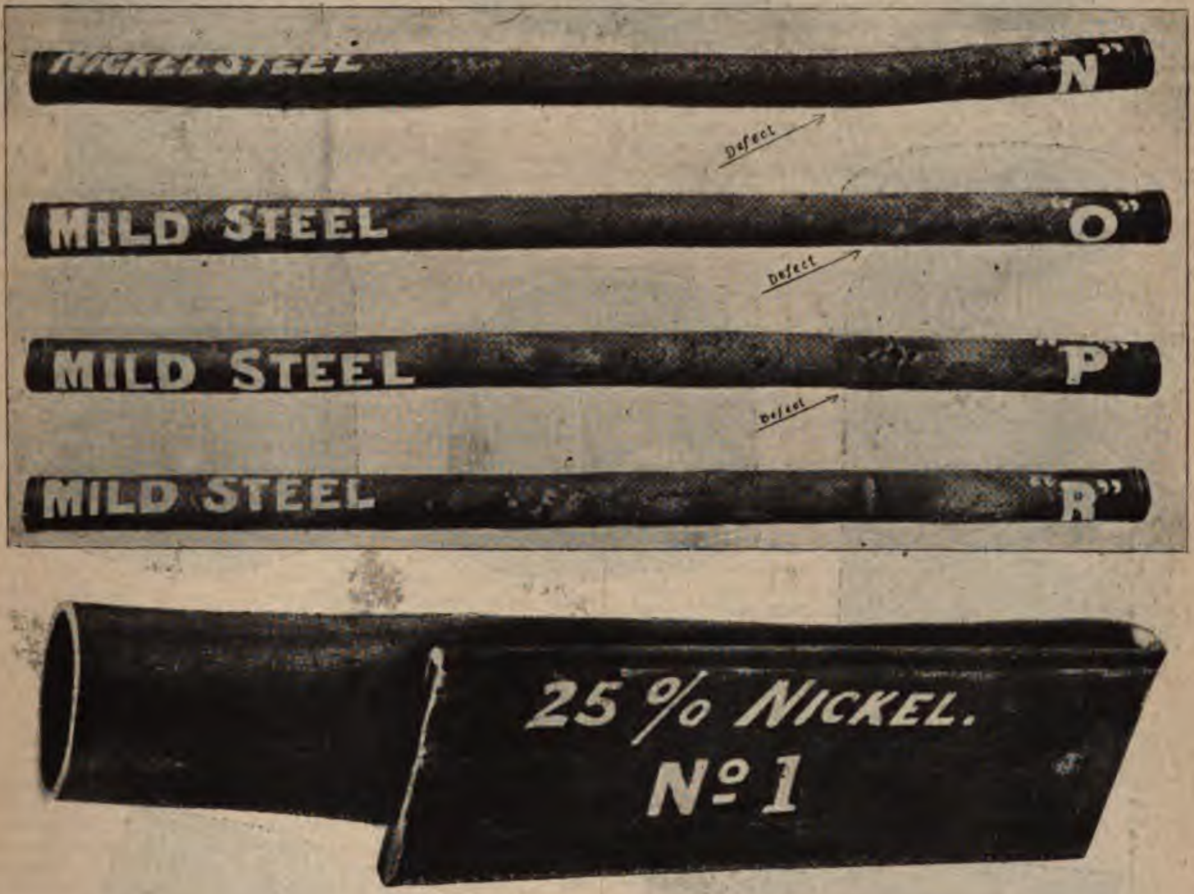


PLATE 3.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

I MUST begin with answers to two kind correspondents. In the first place with regard to the gentleman from Cheshire who reminds me of the promise of a memoir of the

"Alaska,"

I would tell him that pressure on my space makes me hold it over for the present. And, indeed, the useful life of the good ship does not yet seem entirely closed. When I last spoke of her she had just been sold to a Sheffield shipbreaker for the sum of £17,500. This looked like the end, but it is not. Messrs. Vickers, Son & Maxim, who are largely extending their works at Barrow, find great difficulty in housing their augmented staff. They are building, it is said, no less than a thousand workmen's houses on Walney Island to meet the deficiency; but building takes time, and the need for accommodation was urgent. So they have given the Sheffield shipbreaker fifteen hundred pounds profit on his bargain, and have taken the *Alaska* for use as a temporary floating home for four hundred workmen. In July the old ship left the moorings in the Gareloch, at which she has so long lain, and under her own steam proceeded to Barrow, where she enters upon her new, if less pretentious, sphere of usefulness.

My other correspondent, who dates from county Dublin, calls attention to a slip in my remarks on the

City of Dublin Steam Packet Company

in the June issue of these notes. I was wrong, as he very properly points out, in saying that Messrs. Blackwood & Gordon have built six screw-steamers for the Liverpool and Dublin service. They have built six steamers, truly enough, but the first of these was a paddler; and I must further plead guilty to the charge of having omitted to regard the presence of two modern paddlers in their fleet. About the year 1880 they bought certain screw-steamers whose work probably—amongst other circumstances—contributed to show the manager that the day of the paddler was commercially closed. But they still built the *Meath* and the *Galway* on the old principle. These two vessels, as well as the *Mayo*, which I mentioned in the note criticised, are still in their active fleet.

The P. & O. Co.'s "China."

The work of preparing this vessel for rebuilding seems lengthy. There has been considerable difficulty experienced in getting away all the temporary work so well put into her at Perim. High explosives have had to be called into requisition, and at one blast a mass, estimated at 700 tons, of concrete and steel was dislodged. What the expense entailed may be, and

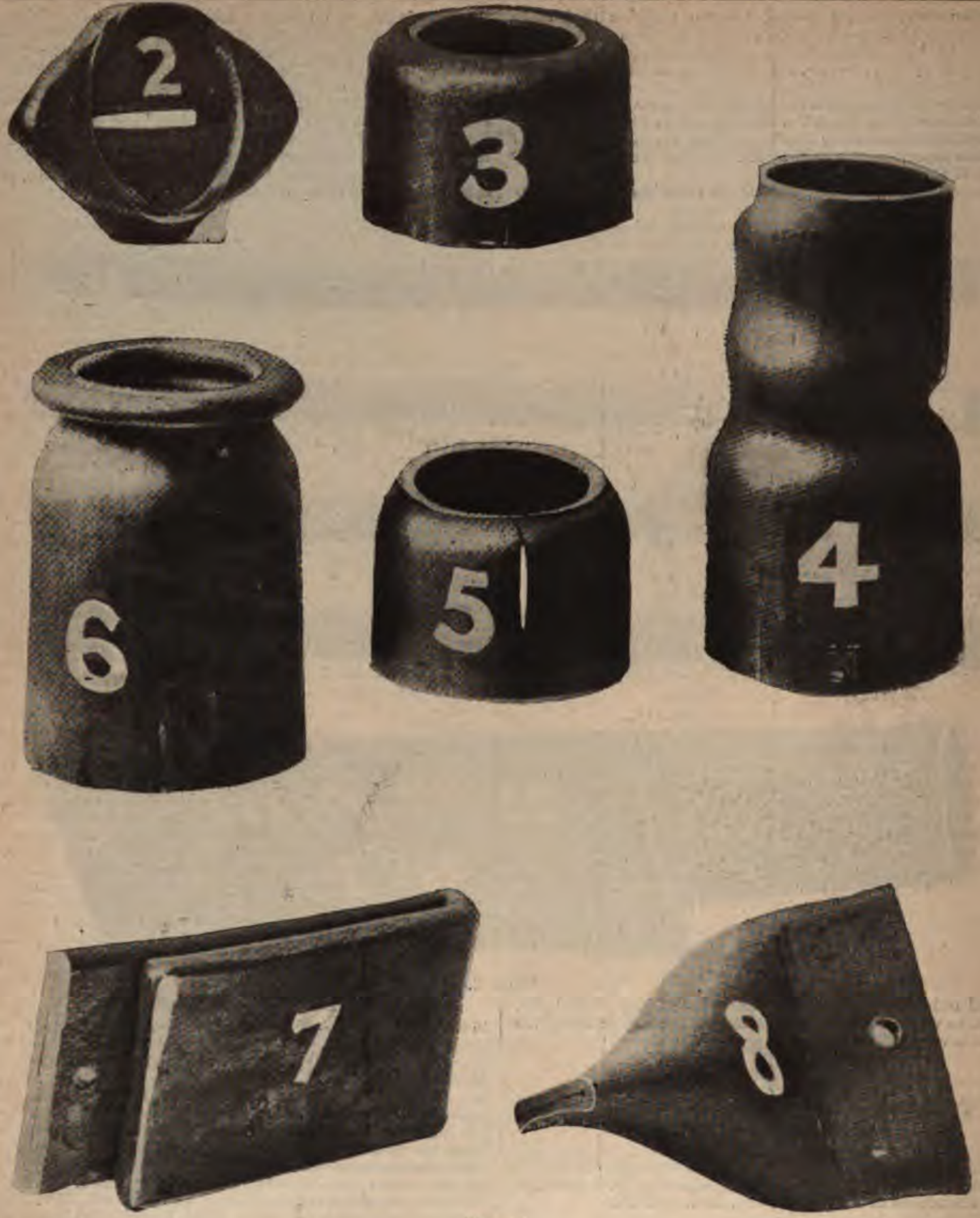


Plate 4.

Some Experiments having Reference to the Durability of Water-Tube Boilers.

how much of the original structure may remain to be worked into the new ship that is to take her name and place in the P. & O. fleet, my readers can imagine for themselves. They are never likely to know it officially, nor are they likely to know what Messrs. Harland & Wolff's bill for repairs will be; for, by a stroke of genius worthy of the mind which directs this fleet's concerns, it has been determined that whilst in Messrs. Harland & Wolff's hands the ship shall be lengthened by an additional 50 ft. Thus her carrying power will be largely increased, the shareholders will have a better earning machine than they had before, and at the same time it will be impossible in the big bill which will have to be liquidated to disentangle the charges due to repairs from those which should very properly be put down to new construction.

The "Stella" Disaster

The London and South Western Railway are about to replace the unfortunate *Stella* with a steamship of the type of their most recent acquisition, the *Vera*. This means that she will be of the twin-screw triple-expansion type, like the vessels in the Havre service and most of those plying to the Channel Islands. The difference in the vessels chiefly consists in the arrangement of their passenger accommodation. The more recent vessel is the spare boat for both services, and she is therefore now engaged in filling the *Stella's* place. She is characterised by the fact that her accommodation is arranged for running either on a day or a night service.

Southampton v. Liverpool.

In the last notes I referred to the first of Mr. Smalley's articles in the *Times* on Transatlantic liners. Since I wrote the second of these has appeared: in it he shows how the advantages which Southampton gains by her proximity to London are sacrificed by the utter want of management at Waterloo Station. Anyone who visits Waterloo Station will appreciate this comment.

The New "Oceanic."

Mr. Smalley, however, in the article in question, made one misstatement which served a useful purpose. For he said that Mr. Ismay had found out that the public craving for excessive speed in Atlantic mail steamers was greater than that experienced shipowner had imagined, that in consequence the *Oceanic* was having more boiler power placed in her. This would have been ill-bearing indeed, for it would have meant that the *Oceanic* was foredoomed to failure. Ships which are altered from their original design never succeed. Experience has shown us that. But our fears—if we ever believed what we read on this head—were speedily put to rest by a letter from Mr. Ismay himself in which he—and he ought to know as much about his own ship's internal economy even as the *Times* detailer of New York society functions—denied most emphatically that the first design had ever been in any way tampered with.

A Big Deal

has been effected in the sale by the New Zealand Shipping Company of its four more purely mail and passenger steamers. It may be remembered that when this company first went into steam it chartered a number of steamships belonging to other lines. These included certain White Star boats. Then it constructed five steamers of its own, and with them maintained for many years a regular four-weekly service between London and New Zealand ports. The five vessels in question were the *Aorangi*, *Tongariro*, *Ruapehu*, *Kaikoura*, and *Rimutaka*, which were built in the order named. All came from the famous yard of John Elder & Company, of Fairfield. These were all barque-rigged screws, well able to use their canvas in aid of their steaming powers. They came out in the years 1883 and 1884. The first three were 389 ft. long and just under 4,200 tons gross register. The latter pair were about 40 ft. longer, and of about 300 tons greater tonnage, than their earlier sisters. All had compound engines. Changes have come over the trade since those days, and vessels of a very different class have taken their place. The new comers are slower, larger, and cheaper to run, whilst they have much greater refrigerating installations. So the older boats have found their places filled. The *Aorangi* was parted with some time ago. Re-engined and boilered, she joined the Huddart Line between Sydney and Vancouver. This I incidentally referred to in last month's Notes. The *Tongariro* and the *Ruapehu* have been recently running in the Beaver Line (Associated Steamers) under the management of the Messrs. MacIver, of Liverpool. Before she entered on that service the last-named distinguished herself by the feat of towing out the huge floating dock—built for the Spanish Government by Messrs. C. S. Swan & Hunter—from the Tyne to Havannah. The whole are reported to have been bought by British buyers, who are stated to be the British India Steam Navigation Company, Limited, at a price of about £75,000. As the ships aggregate about 17,300 tons, the price is something over £4 a ton for 16-year old vessels.

The Hamburg-American Line

has made a new departure for foreign liners. They have announced that they have adopted the precautions of having a deep-load line. The German Emperor has signified his pleasure and satisfaction at the move. But personally, in the absence of further information, I fail to see exactly where the benefit comes in. We are not told on what principle the marking is to be ascertained. Until we have some explanation of the rules which shall guide those who are to fix it, it would appear to be a very unnecessary precaution. There is no magic in a load-line, nor in a disc by itself. The only value comes when it is affixed under rules which enforce that it shall be so placed as to give the ship ample reserve buoyancy, and when there is authority behind those who fix it to take care that under no circumstances shall the draught it allows be exceeded. A voluntary load line may be quite a negative blessing.

A far more promising innovation is that which has been announced by

The Atlantic Transport Company.

Profiting by the loss of the *Mohegan*, whose end is attributed to an error in judgment, such as those to which other captains and other human beings in general are liable, it has taken the best means in its power to avoid the possibility of the recurrence of such a failure. An order has been issued from the office to each master in its employment enjoining that in future the ship's course is to be set by the junior officer of the watch. All their ships carry two deck officers at all times, and so the work of the junior can hardly escape the criticism and, if need be, the revision of his superior. Above both comes in the master, who doubtless will be only too glad to show occasionally that his officers are not yet quite perfect in their navigation. So under the new system three people ought to be at fault before an error can have fatal results. Possibly it may be said that the same could have been urged of the old system. This may be true. But no one with any knowledge of methods at sea, and of the discipline there observed, can suppose that juniors could have been as quick to criticise the work of the commander himself as the latter must be to check the work of those under him.

La Bourgogne.

I had hoped, as I said last month, that we had done with this sad story. But it has cropped up again. This time it is before the French courts, where the widow of a passenger has been awarded £4,000 for the loss of her husband through the disaster, which, as the French courts now decide, was due to the fault—at least, in some measure—of the company's servants. This judgment looks at first sight to be a very severe blow to the company, especially as we hear from similar sources that a very large number of actions hang on that which we are discussing. But there is a reservation in the case which has not attracted much notice. It is, however, likely to prevent the widow from reaping any very tangible satisfaction from her legal victory. The award is "subject to the option of the company to renounce all rights over the vessel and her cargo." They are not likely to think twice about the matter. The vessel lies in the bed of the Atlantic. Her cargo is with her, and the chance of any salvage is remote and shadowy indeed. *Per contra* the claims in respect of her loss are very solid and immediate, and there can be little doubt of the course which the company will take. If this is French maritime law—and there is no doubt that it is—the conference which is now sitting with a view to induce this country to assimilate its jurisprudence in maritime affairs to that of the Continent is not likely to meet with much success. A worse illustration could hardly have been put forward.

The Norddeutscher Lloyd

is very unfortunate with its new fleet of express steamers for the New York service. The *Kaiser Wilhelm der Grosse* indeed has proved herself a magnificent success. She is deservedly popular with the travelling public, and has just broken her own record eastwards by running to Cherbourg at the fine speed of 22·61 knots. The *Kaiser Friedrich*, built to be her equal in speed with a 20 per cent. saving in displacement, has, however, not yet achieved contract speed, and accordingly has, after about a year's trial on the station, been withdrawn from the service and returned to her builders. Doubtless we shall yet see her doing what was promised of her. But it is hard on the company that they should have been deprived of her services during the present passenger season, when all the Americans who were kept at home last year by the war are coming across to make up for lost time.

The *Kaiserin Maria Theresa*, too, has had bad luck. She was completed in due course, and was advertised to take the outward sailing of the 14th June. But on her way round from Stettin she went ashore, and for a time resisted all the efforts that half-a-dozen powerful tugs could put forth. She came off at last, and on the 26th June reached Stettin for repairs.

The Isle of Man Competition.

On July 1st, according to promise, the new Isle of Man Company started its daily excursion service from Liverpool to Douglas with the ex-Royal Mail steamship *Ireland*. The old company detailed their *Queen Victoria* to run against her, and the return fares for the excursion were reduced to 4s. first and 2s. 6d. second class. The *Ireland* did not do well on this day. Her time for the round trip was as much as eleven hours, against just under six hours by her rival. The practice with the *Ireland* was a good deal better on the Monday and Tuesday of the following week. But on the Wednesday the new adventure made its last sailing for the time being—the management announcing that the withdrawal was only temporary, and that further sailings would be announced. It would appear that the failure of the *Ireland* to do anything approaching her normal speed was due to trouble with her feed pumps. It is promised that this shall be remedied. The old company's service should really satisfy the most exacting public, for though the 20-knot *Queen Victoria* was only offered to them at these excursion rates on account of the opposition, and was not continued to them after that opposition ceased, they still had the still faster *Empress Queen*, which on July 4th exceeded a speed of 22½ knots on the Liverpool-ward run, working every day in the regular services. A table of the performances of the three vessels named has been published, but I do not think it of sufficient public interest to warrant my reproducing it. It may, however, be worth remarking that the *Queen Victoria* herself, with her sister ship the *Prince of Wales*, came into the possession of her present owners through a similar competition to that now existing. The two steamers in question were built at Fairfield for an opposition line to the Isle of Man, and were bought out and taken over by the old-established line.

New Companies.

During the month of July the old-established shipbuilding and engineering firm of Wigham, Richardson & Co. has taken advantage of the limited liability Acts, comingout with an issue of £220,000 in ordinary and preference shares. The object of the change is stated as preliminary to an extension of the enterprise. It appears from the prospectus that the concern dates as a shipbuilding yard from 1860, the engine and boiler shops having been added twenty-one years later. At present the output is nearly thirty thousand tons of steel shipping per annum, whilst the engines turned out in the year indicate about 80,000 H.P. There are about two thousand hands employed.

The Anchor Line followed the same course a week later. Its capital amounts to £575,000, in preference and ordinary shares, with £325,000 debentures. Of the share capital only the preference, amounting to a quarter of a million sterling, were offered for subscription, the partners in the old firm of Henderson Brothers taking all the ordinary. The fleet is stated to comprise twenty-two vessels aggregating 79,742 tons, whose value is stated by the certificate of Messrs. Kellocks to be £535,000. But the company does not own quite the whole of the fleet, one-sixth per cent. interest in it is stated to be "held by large and influential supporters of the line." On the other hand, the fleet is by no means the only asset. There are interests in the shipbuilding and engineering business of Messrs. D. & W. Henderson, of Glasgow, in the Barrow Steamship Company, and in the Ship-Chandlery and Sailwork Company of Glasgow. Details of what is comprised herein are not afforded, but we are told that they are worth another £160,000.

Southampton

is said to be handicapped by the fact that it has no graving dock of what are now the ordinary dimensions for big steamships save its Prince of Wales's Dock. This, of course, will accommodate the biggest steamships afloat. But when this is occupied there is no power to deal with casualities to large vessels. A dock of some 700 ft. is now projected, and its addition to the facilities of the port will certainly make them capable of dealing with any calls likely to be made upon them in the direction of dry-docking, at least for some time to come.

The American Line

omitted its sailing from Southampton on Saturday, the 15th July. This was done to enable the *St. Louis* to take a three weeks' rest in dock, where the Clydebank workmen will fit her with the bilge keels which have proved themselves so effective in the case of the *St. Paul*. The line has of course been deprived of its reserve ship by the unfortunate catastrophe to the *Paris*. But, nevertheless, it hopes, with the three remaining ships, to fill all its mail dates till the close of the year.

The Paris,

to the surprise and delight of the salvors, who were, I think, beginning to despair, came off unexpectedly at 8.30 p.m. on the 11th July. She did so whilst the salvage boats, unaided by tugs, were attempting to slew her into a more convenient position. She was immediately made fast in the immediate neighbourhood of the place where she had been fixed for some seven weeks. There tightening and pumping were resorted to, till at length some of her own steam could be used in aid of her salvors. On the night of the 12th she was towed towards Falmouth, and by 7.30 a.m. on the morning of the 13th was safely brought into the inner harbour there and safely stowed, though with a heavy list to port.

Meanwhile her unfortunate commander, who took to himself the whole blame for the accident, has been suspended for two years by the American authorities who investigated the case. His explanation was that on the night when he left Cherbourg on the fatal trip, Cape La Hague was abeam at 6.38 p.m., and at 7.35 the Casquets were in the same relative position. The former point being 131 miles from the Lizard, he reckoned six hours and 54 minutes as the time for the run to that point, but unfortunately he took 7.35 instead of 6.28 as the time of his passing Cape La Hague. Thus he overran his distance by 18 miles. The detection of his mistake, was he says, prevented by the thick weather, which obscured the Lizard lights. The inspectors who reported on the case to the United States authorities, however, insist that the fact of the distance being overrun was not the only thing which contributed to the disaster. He was also seven miles to the northward of his course, and that, they say, must be due to a failure on his part to make any allowance for the flood tide which was running. For these failures and for non-use of the lead, this very heavy punishment is meted out to him. It is sad to think that this has befallen a man who did well indeed for the old Inman Company during a long series of years, and who earned national thanks and high naval rank for his conduct in the recent Hispano-American War. Especially unfortunate is it when it is noted that this was to be his last season's work before retirement. The case is one, however, of which the repetition seems to be provided against by the precautions which (as mentioned in an earlier note) are being insisted upon by the Atlantic Transport Company. It is simply a case of the failure of the human element—a thing that must always happen occasionally even with the most zealous and capable officers. The results of such failures are always disastrous in their magnitude in direct proportion to the power and weight of the man who makes the mistake. A duffer's mistake is not unexpected and may be provided for.

La Compagnie Generale Transatlantique

will now be able to make a sailing once a fortnight in its mail service with a fast twin screw-steamer, and that at once and without waiting for the completion of its new fleets. The French Government has given them permission—at least temporarily—to use the once-named *Normannia* in their mail service. She will be a worthy companion both in speed and in size to the French-built *La Touraine*. Whilst under the Spanish flag the *Normannia* was known as the *Patriota*. Now that she becomes French, she will be called *L'Acquitaine*, it being the custom of her new owners to call all their Atlantic mail steamers after provinces of France. It was a little unfortunate that, when leaving Ferrol at the beginning of July whilst still in charge of the Spanish pilot, the new acquisition of the French company should have gone ashore and sustained sufficient damage to render it advisable for her to put back to the Spanish port. This accident, though not a great matter in itself, will postpone the period when *L'Acquitaine* will be ready to enter on her new owners' service till too late for her to be of much use to them during the present passenger season.

Mr. Ismay

was, on the 20th July, presented with the freedom of the city of Belfast, he being but the second recipient of that distinction. That Belfast honoured herself by recognising the benefits which Mr. Ismay has conferred upon the city goes without saying. The interest of the White Star Line (which Mr. Ismay has created to an extent that no other line can be said to have been the produce of one master mind) is indissolubly connected with Messrs. Harland & Wolff's great shipyard and with the port and city of Belfast. Briefly put, Mr. Ismay's firm has spent

THE NEW YO
PUBLIC LIBR
OR, LENOX
N FOUNDA

seven millions on new construction in the yard, and has, with the product of Belfast industry, carried the knowledge of her skill in design and faithfulness in workmanship into every sea. The three hundred thousand tons of shipping which the White Star Line has itself taken from Belfast is by no means the measure of the advantage which the connection has done the city. When the long connection, now further cemented, began, Messrs. Harland's yard confined its attention to shipbuilding merely, and did not concern itself with passenger vessels. Now, and for many years past, the excellence of the work which it puts into hulls, machinery, and fittings has made its name a hall-mark in itself.

The details of the ceremony need not be here referred to. But there were one or two points about the matter which ought to be recorded. The casket in which the certificate of citizenship was presented to the new freeman was the gift of the working men, and it was remarked that they were so appreciative of Mr. Ismay's title to their affection that the subscription had to be kept down in order to enable all those who wished to do so to participate in the giving. In this regard—that of the relations of capital and labour—Mr. Ismay, alike for himelf and for the shipyard, had some claim to speak. Labour difficulties in his own business are unknown. Any delays that may take place in the delivery of White Star ships arise not from trouble at Queen's Island, but from the fact that difficulties elsewhere are cutting down the supplies of necessary material. The secret of Mr. Ismay's success has been that his motto has ever been, "Do as you would be done by." He has treated those who worked for him with generosity and they have responded in the same spirit. His gifts have ever been on a princely scale, and they have always been directed towards the most worthy objects, and such as were peculiarly within his own view and connected with his own work. As an employer of seamen he gave to the Aged Mariners' Fund at Liverpool. As one who had ships built at Queen's Island, where, in spite of all care, accidents must happen from time to time in the army of men employed, he lends splendid assistance to the Victoria Hospital of Belfast.

Recent Casualties.

The *Gallia* proves to have been uninjured by her sojourn on St. Lawrence mud, and the salvage claims against her have been settled for £4,000. But the Warren liner *Norseman*, which some time ago went ashore at Marblehead, and after prolonged operations was got off and taken to Boston, has been sold at the latter port to a Philadelphia shipbreaker for about 17,000 dollars. Since she changed hands there has been a fire aboard her as she lay at her anchors in Boston Harbour. The hull seems to have sustained but slight damage, though a number of staterooms were gutted.

The Gaspesia.

The fate of the crew of this vessel has been a very instructive —if very unfortunate—one. Engineers should read the letter which her late chief has sent to the Press, and pause before they ship with new companies owning old ships. I have from time to time recorded the adventures of this ancient P.S.N. boat, which the Canadian Steamship Company, Limited, had purchased for some £8,000 and renamed. How she was frozen into the ice off an "ice-free" port, and how after upwards of two month's imprisonment she was freed by the sealing steamer *Kate* and taken into St. John's, Newfoundland. There the salvors naturally claimed salvage, and were awarded a sum of £2,500 by the local Vice-Admiralty Court. The master communicated with his owners, and, it is said, no reply ever came to him. The salvors, getting no satisfaction for their claim, seized the ship, and the men, to whom no less than £2,000 in wages were then owing, were turned out into the streets of a Colonial town. This is very hard lines on them. But the law gives a priority to the claim of a salvor against the ship over that of the seamen; for it very fairly says, "if the salvor had failed to render his service there would be no ship for the seaman to claim against." The seaman has his rights against the owner as well as against the ship. Had the men who shipped aboard the *Gaspesia* made inquiries, they might have ascertained the financial position of the company which owned her, and they would not have shipped. They suffer from their want of caution. The sad experience will be of advantage to the general body of engineers and seamen if it teaches them to regard provable facts in connection with limited liability companies, and not the frothy and untrue statements concerning connections and prospects which the halfpenny London Press is only too glad to circulate, without discrimination, and let me hope, without inquiry.

Derelicts.

The neglect of the authorities to remove the numerous floating derelicts which render dangerous the passage of the Atlantic has long been a crying scandal. All kinds of absurd excuses have been advanced in palliation of the supineness of the authorities. But at last one case has been too glaring for silence to be maintained on the part of those who have the safety of the Atlantic at heart. So in the case of the waterlogged *Siddartha*, Lord Iverclyde, of Cunard's, and Mr. Ismay, of the White Star Line, at last addressed the authorities. When such men spoke the Admiralty had to act, and at once the obstruction was sought for, found, and recovered. The feasibility and the immediate pecuniary advantage of removing such dangers being proved, it may be hoped that a general clearance will be effected.

Cardiff

considers itself a progressive port. It is somewhat doubtful if outside its own borders the opinion will in future be entertained. Messrs. Ismay, Imrie & Company intended to give it direct communication with Australia by the new Australian line of whose inception I spoke in the last lot of notes. The *Medic* was to have coaled at Cardiff, and her sisters were to have followed her example. Four thousand tons of bunker coal would thus have been taken each month from the port by these vessels, and in addition there would have been the cargo facilities which the calling of such steamships at the port would have offered to shippers and consignees of meat. Cardiff did not see how it was to fulfil the very proper requirements of the line, and accordingly the whole suggestion has fallen through. This is not the action which might have been expected of an up-to-date harbour authority.

Canadian Mails.

The fast service to Canada comes not. But changes in the mail arrangements are always with us. The Allan Line, and with it the Dominion Company, are again deprived of their contract, and Messrs. Elder, Dempster & Company are now charged with the duty of carrying postal matter between England and her nearest colony. The newly engaged mail boats will leave Bristol each Monday, and call at Queenstown on the following day to embark the mails. The arrangement commenced with the sailing of the *Monterey* on July 24th. It is too soon as yet to do more than chronicle the fact of the contract. Its working must be regarded in future issues. But these constant changes, not only in contractors but in ports of departure, cannot fail to be highly prejudicial to that stability which is one of the essentials in mail service.

Cunard Engineers.

The Cunard Company has lost the services of Mr. Anderson, chief of the *Lucania*, and of Mr. Cuthbertson, chief of the *Umbria*, after 41 and 35 years' service respectively. On June 27th handsome presentations were made to each of these gentlemen, to show the appreciation in which they were held by their fellow-engineers in the Cunard fleet.

THE "SIRIUS" PULSATING PUMP.

IT is somewhat remarkable that the principle of the first steam-pumping engine evolved by Savary should still find a place in the commercial devices of the present day, more than 200 years after its inception. But such is a fact, as exemplified by the number of designs of this type of pump at present placed on the market by different manufacturers, many under fancy titles of ingenious construction. And, further, that as time goes on, improvements are made therein which have a very beneficial effect upon their efficiency.

The latest example in this direction is the Sirius pulsating pump, made by Messrs. Holden & Brooke, Limited, of the Sirius Works, West Gorton, Manchester. We illustrate this pump in the adjoining diagram, in which Fig. 1 is an external elevation of the pump, Fig. 2 a mid-vertical section of the same, Fig. 3 a transverse section on the line *a b* Fig. 2, and

Fig. 4 details views of the steam valve. In this class of pump a needless waste of steam is often caused by the hesitating and uncertain action of the steam valve and by its generally slower and less responsive movements. The steam not only passes at a time when it can do no work and is consequently wasted, but also when its presence actually retards the action of the pump. Further, in some forms of pulsating pump, either for cheapness or appearance, the pumping chambers are merged externally into one casting, separated internally by a diaphragm common to both; as now one of the chambers is alternately full of cold water while the other is full of steam, it follows there must be a very useless dissipation of heat through this diaphragm from the steam to the water.

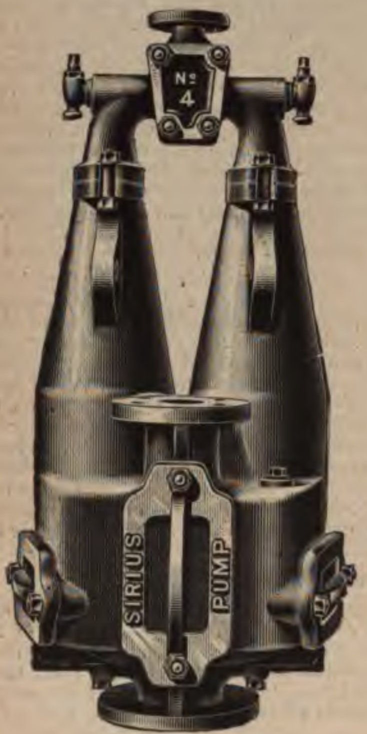
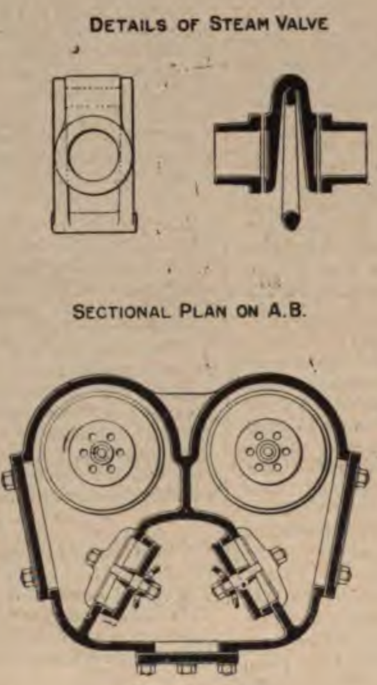


Fig. 1.



Figs 3 & 4.

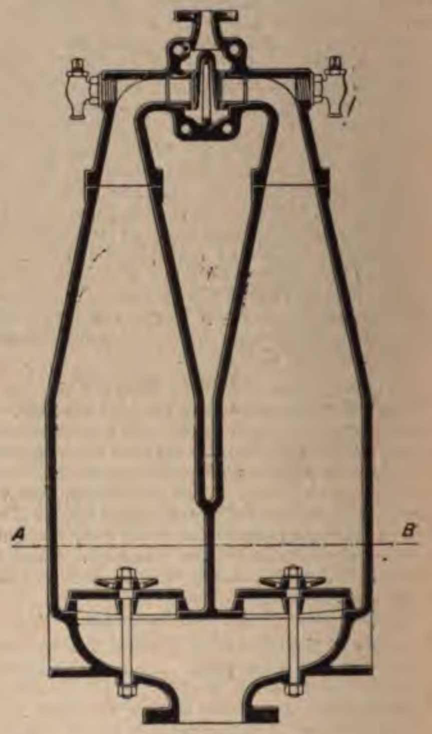


Fig. 2.

In the Sirius pump the chambers are separate and distinct, hence this useless expenditure of heat cannot take place. The chief feature, however, in the pump is the novel design of steam valve, made according to Brooke's patent, and which is clearly illustrated in Figs. 2 and 4. The manner in which this valve is hung renders it unusually sensitive and quick in its beats from side to side. On this account the heavy loss of steam at the commencement and end of each stroke before referred to is entirely avoided, and greater regularity of pulsation is secured.

Referring to Figs. 2 and 4, it will be seen that the valve is saddle-shaped, and swings freely on the top edge of a vertical plate, which, in its turn, is free also to rock on its bottom edge in a groove provided in the main casting for this purpose. The arrangement is such that it is very responsive, and swings between its two seatings with great certainty and rapidity. A further important feature of this form of valve is that its construction enables it to adapt itself to and bed dead upon its seating, owing to it being able to move freely in two directions; as in addition to swinging vertically on the plate, it can also, to a certain extent, twist sideways on it in a diagonal sense, thus enabling it to bed true on either of its seatings, even though the latter should not be parallel with each other.

The valve and vertical plate are so arranged that they cannot get out of place or touch the sides of the valve chamber, however the pump is placed. The valve is easily removed and refaced, if required, but freedom from rapid wear is provided against by the valve and seating being made of phosphor bronze and having faces of ample area. An improved form of air valve is provided, which aids to ensure greater reliability in the action of the pump, and it is claimed that in this respect the carefully designed details of the pump body generally materially assist.

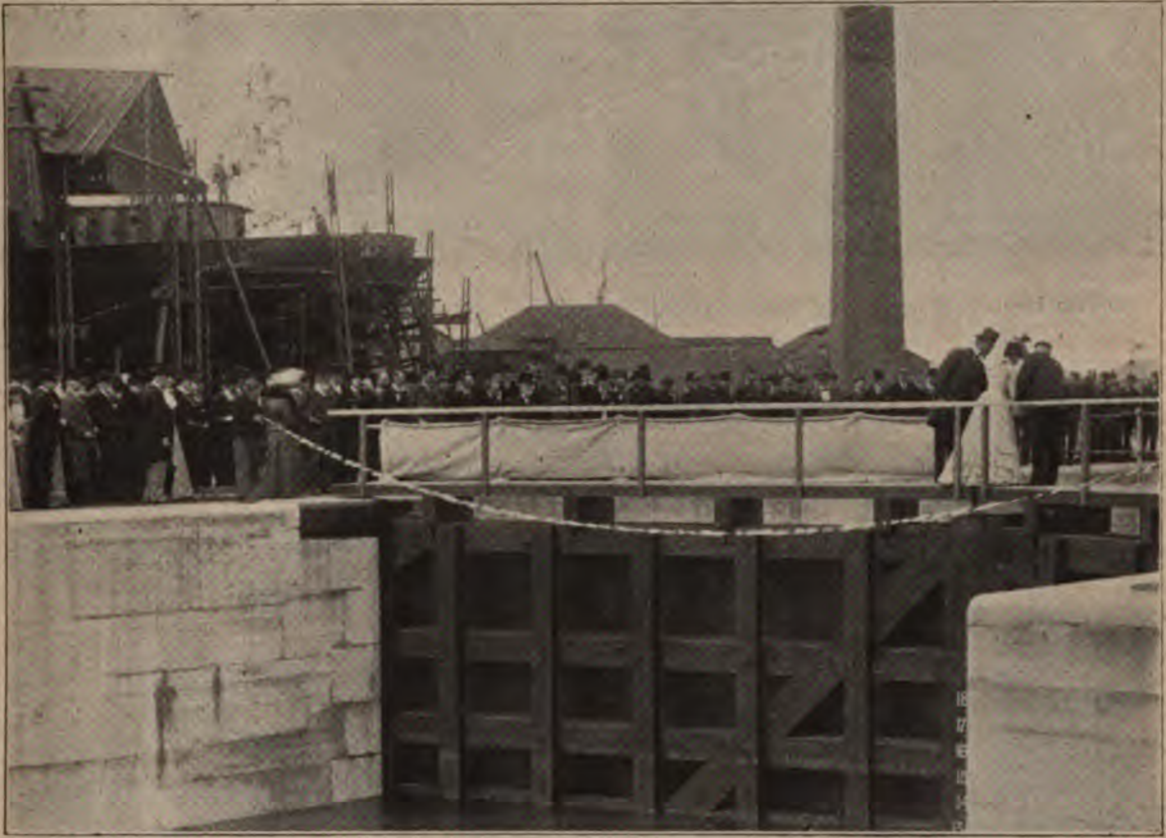
It is impossible to adequately state the many and varied purposes to which this class of pump is applicable; however, it may be stated generally that they can be employed with advantage in every industry and for every purpose in which liquids are required to be moved or raised readily, quickly, and cheaply, and where the nature of the work calls for an apparatus that demands no care or skilled attendance, but which can be relied upon to work continuously without any risk of failure or breakdown.

Inadsuma.—The Japanese torpedo-boat destroyer *Inadsuma* arrived at Yokohama on Tuesday morning, June 27th, having steamed all the way from London. This is the second boat to arrive in Japan out of the six being built by Yarrow & Co. for the Japanese Government, and is exactly similar to the *Akebono* lately tried on the Thames.

THE SHIPBUILDING AND DOCKING FACILITIES OF TROON.

TO the dry-docking facilities of the port of Troon on the Ayrshire coast—which are all practically in the hands of the Ailsa Shipbuilding Co.—a highly important accession has recently been made in the new graving dock which was ceremoniously opened by the Marchioness of Ailsa, on the 29th of June last, and is illustrated herewith. This dock, which has been under construction for about two years past, has been built at the expense of His Grace the Duke of Portland, the superior of Troon Harbour, but will, as above indicated, be leased from that nobleman by the Ailsa Shipbuilding Company—to whose yard and workshops it is immediately adjacent—and worked by them as ship-repairers in all branches.

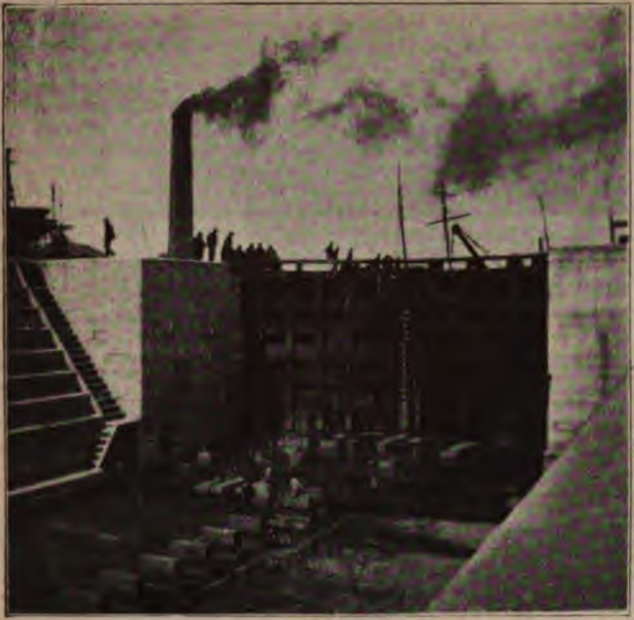
It is interesting to recall the fact that, till about the year 1860, Troon possessed the largest dock on the Clyde, and that Glasgow, owing to shortcomings in this way, had to send her largest ships to the Ayrshire port for repairs. One of these was the steamship *Glasgow*, a crack Atlantic liner of her day. This dock was built by the fourth Duke of Portland in 1820, and, though small, as modern requirements go—being 275 ft. long, 37 ft. wide at entrance, and having a depth of water on sill at mean high tide of 10 ft.—is still in existence, in good working order, and in constant use by the Ailsa Co. Another and smaller graving dock existed for many years at Troon, but being contiguous to the site of the new dock just opened, it has been filled up, and the ground thus recovered has been added to the shipbuilding area of the yard, thus enabling the Ailsa Co., to increase their building berths to six, and otherwise improve their premises.



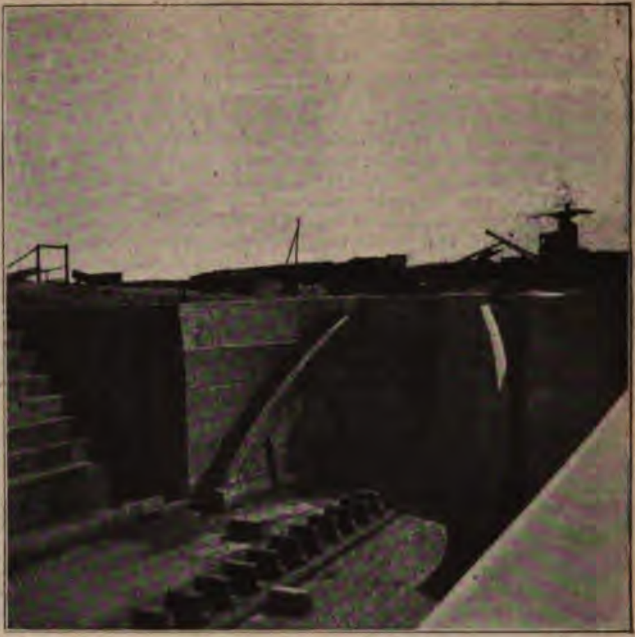
Opening Ceremony of the Ailsa Shipbuilding Co's New Graving Dock.

Before further referring to the vigorous and excellent work carried on by the company, and to the most recent accessions to their working facilities—thanks to the enterprise and public spirit of the noble superior, and of his able business agent, Mr. Adam Wood—a few notes reminiscent of what Troon has been as a shipbuilding and shipping locality will be interesting. The fourth Duke of Portland came into possession of the estates in 1808, and he immediately commenced the construction of the harbour. Almost concurrently a tramway was made from Kilmarnock to Troon Harbour, supposed to have been the first of its kind in Scotland. Having got the harbour made, and the tramway with wagons drawn by horses to convey coal from his own pits about Kilmarnock to Troon, he soon began to build ships in which to convey the coal to Ireland. His Grace started his shipyard at Troon, and employed as his designer and builder Mr. William Symonds—afterwards Sir Willliam Symonds—who became a man of note, and was employed in the service of the Admiralty, designing many celebrated men-of-war in his time. The coal-carrying ships were mostly of small dimensions and bore such local names as *Kilmarnock*, *Tarbolton*, *Galston*, *Dundonald*, &c., but as the "good old Duke," as he was spoken of, was also a keen yachtsman, he employed his designer's abilities in connection with yacht architecture as well. Notable amongst the productions of this class was the *Pantaloon* a 10-gun brig of 320 tons, built in 1831. This brig, in a series of trials, raced with and beat the frigates of Admiral Codrington, off the Dodman, in the same year, after which his Grace presented her to the Government, who, recognising her exceptional merits, employed her as a slave-catcher on the West Coast of Africa.

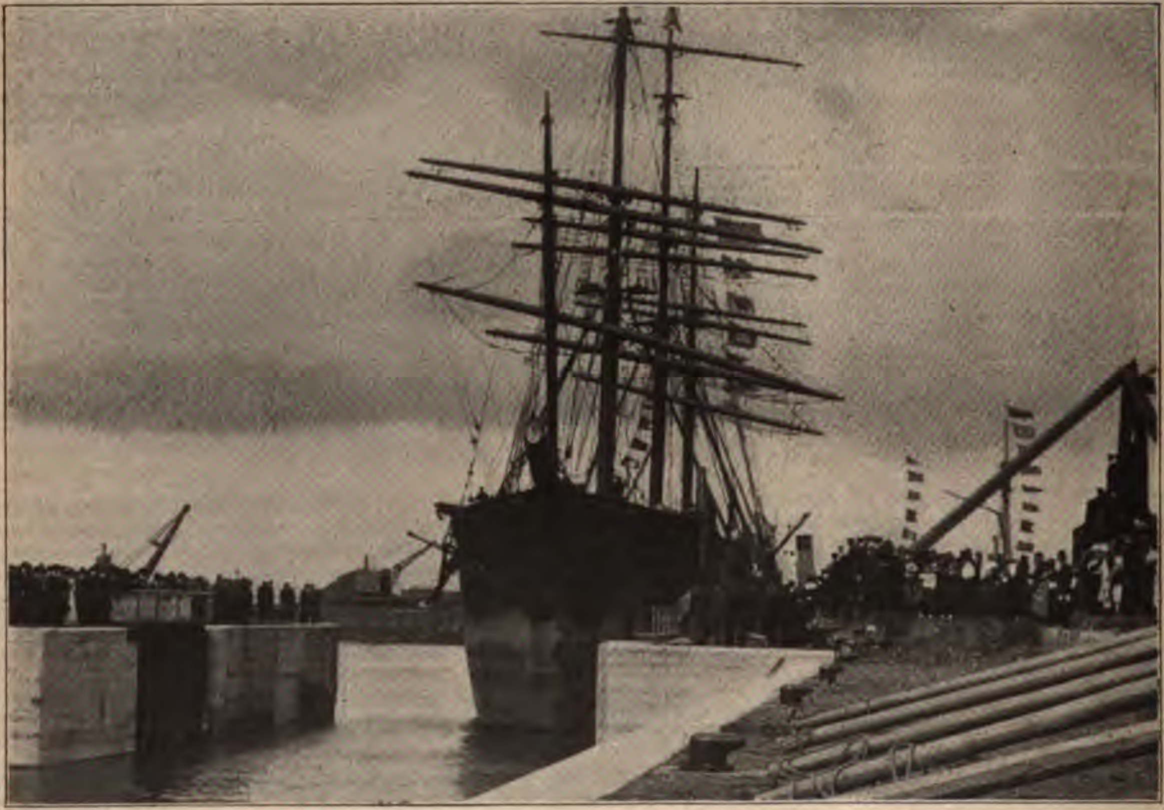
After the Duke's time the shipyard was let, and the building of vessels of wood was carried on by several firms in succession, until about 1850, when the Portland Shipbuilding Co. came into possession. Under the management of the late Mr. John Hay, this company built the *Earl of Eglington* in 1854, the largest wooden ship which up to that time had been constructed in Scotland. She was full-rigged, and was employed in the East India trade. Further on in the sixties there were built three celebrated China clippers, the *Silver Eagle*, *Fire Queen*, and *Salisbury*, for Messrs. Somer & Co., London. The *Silver Eagle* specially distinguished herself as the winner of the race from China to London, at the time when tea was all brought in sailing ships round by the Cape of Good Hope. In 1866, the shipyard went into the hands of the Troon Shipbuilding



Showing Inside of Gates, Troon Graving Dock.



Showing Head of Troon Graving Dock.



The Full-rigged Ship "E. J. Spicer," of Nova Scotia, entering the Ailsa Shipbuilding Co.'s New Graving Dock.

Co., who continued building and repairing till 1886, after which the yard was taken over by the present company.

Concurrently with the taking over of the yard by the Ailsa Shipbuilding Co., Troon, entered on a new era in its history as a shipbuilding port, by the starting of iron shipbuilding, in which work the three active partners—besides the Marquis of Ailsa—had exceptional training and experience. These were Mr. Alexander McCreadie, Mr. Peter Wallace, and Mr. Robert Carswell, the two former having held responsible positions for a long period of years, the first as ironwork manager, and the second as chief draughtsman, in the yard of Messrs. A. & J. Ingles, of Pointhouse; and the latter, Mr. Carswell (who recently retired from the company), having held an equally important post in the commercial department in Messrs. J. & G. Thomson's, now the Clydebank Co. Under the new *regime* the construction of iron ships was soon being spiritedly carried on, the co-partnership apparently having the faculty of attracting customers, and, better still, of giving them great satisfaction in the quality and rapidity of the work produced. Extra ground was taken in, the launching berths were extended, and the necessary ironworking plant was installed, and fittingly housed. Some of the finest cargo boats, passenger steamers, and steam yachts afloat have been turned out by the company. In the two graving docks, the smallest of which has been replaced by the fine new dock which is the direct occasion of this article, a considerable amount of repairing work has been carried on, whilst from the berths the company have launched 80 vessels. They employ 600 workmen, and amongst the work presently on hand are three cargo steamers, a sailing ship, which is the largest yet undertaken at Troon, and two steam yachts.

The new graving-dock, which, taken in conjunction with the enlarged number of berths, should enable the Ailsa Co. to fully maintain their high reputation, is 360 ft. long on floor level, from heel posts of entrance gates to head of dock; 60 ft. broad at floor level; 48 ft. width of entrance, and has 16 ft. 6 in. depth of water over sill at mean high water; the floor level being 4 ft. below sill. A rudder-well 8 ft. deep is below floor level, near the dock gates. These are of timber, the principal parts being of greenheart. The dock has been cut out of the solid rock for the most part, but concrete facings have had to be put on altar courses and floor. There are eight altar courses a side, and access is chiefly provided to the floor of the dock by flights of steps on each side of the bow of dock.

The pumping machinery, which has all been supplied by Messrs. Drysdale & Co., Bon-Accord Works, Glasgow, consists of two centrifugal pumps, capable of pumping about 19,000 gallons per minute, and a leakage pump. These are driven by steam at 80 lbs. pressure, supplied from two Lancashire boilers 24 ft. long by 6 ft. 6 in. diameter. In the chamber which contains the pumps and engines are also valves which connect the new with the older graving-dock, which is situated at the other side of the range of building berths, and enable the necessary pumping operations to be conducted by the same new powerful engines, and under the control of one man. To make this possible the new was connected with the older dock by a tunnel running under the shipyard. The engines previously in use in connection with the older dock will now be utilised for driving the saw-mill plant of the Ailsa Co. On the occasion of the official opening of the dock, on the 29th June, the contents were pumped out in about two hours, the vessel first accommodated being the full-rigged ship *E. J. Spicer*, of Nova Scotia, as shown in one of our views. The contractor for the dock and gates was Mr. George Lawson, Rutherglen, and the whole of the works were carried out according to the plans, and under the superintendence of Messrs. M'Taggart, Cowan & Barker, civil engineers, Bath Street, Glasgow.

THE "STORZ" PATENT HOSE UNION.

THE characteristics of an ideal hose union are without doubt—firstly, that each half shall be exactly alike, so that it does not matter which end of the hose-pipe is coupled; secondly, that the coupling shall be, as far as possible, round, and have no projections, so that couplings cannot be held fast when the hose is pulled along uneven surfaces, and the hose be prevented from being worn more on one side than another; thirdly, that it shall be, as far as possible, instantaneous in its action, so as to save time and labour as far as possible.

In the adjoining illustration we show a very simple, efficient, and economical connection for hose-pipes of every description, which, we think, may fairly lay claim to a practical fulfilment of the conditions as set out above. Fig. 1 shows a perspective view of the two parts ready for engagement, and Fig. 2 is an external view of a hose-pipe and union connected together. Each portion of the union consists of a metal nipple on to which the hose-pipe is secured, and the end of which carries an elastic jointing-ring held in a suitable locking recess. This nipple has a shoulder, at the back of which a coupling-ring is engaged, so as to turn freely on the nipple, so that the hose can be twisted without interfering with the coupling; and, further, it avoids the necessity of twisting either end of the hose when coupling or uncoupling it. On the outer end surface of the coupling-ring two hooked projections are situated, and in the body of the ring between the hooked projections two circular recesses are provided, each having a ledge, or surface, which is obliquely situated to the plane of the ring, and adapted to engage with the two hooked projections of the corresponding part of the hose union when they are inserted therein. At the end of each circular recess an opening is made to allow of each hook entering the recess.

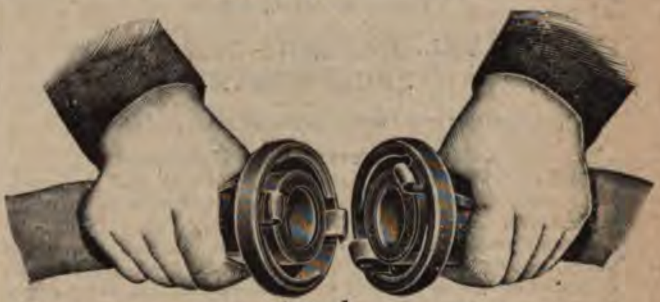


FIG. 1.

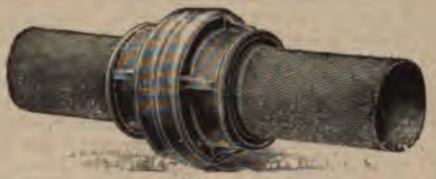


FIG. 2.

When the hooks have been entered into the respective recesses the two coupling-rings are rotated in opposite directions relative to one another, whereby the hooked ends ride up the oblique surfaces and draw the two parts of the coupling together, pressing the elastic jointing-rings into close proximity so as to make a watertight joint.

It will be generally conceded, we think, that this union is a very secure, light, and compact device, and is a most efficient substitute for the old-fashioned screw couplings. As evidence of appreciation of its merits, it may be mentioned that the unions are being used by the Imperial German Navy, the Imperial

Austrian Navy, the North German Lloyd Steamship Co., the Vulcan Co. (of Stettin), Schichau (of Danzig), Blohm & Voss (of Hamburg), Messrs. Wigham, Richardson & Co., and Messrs. Armstrong, Mitchell & Co. (of Newcastle), besides over 20 fire brigades of foreign countries.

The sole licensees of this invention for Great Britain and the Colonies are Messrs. Smith Bros. & Co., of Hyson Green Works, Nottingham.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

The Naval Manœuvres: The Mobilisation.

THE most important matter connected with the Navy this month is, of course, the partial mobilisation for the manœuvres. The mobilisation took place on the 11th of July last, the number of newly commissioned vessels hoisting the pennant being 30 cruisers, four torpedo-boat destroyers, and 24 torpedo-boats, a number of other vessels having their crews brought up to the full complement. From Portsmouth eight vessels were commissioned, their names being the *Europa*, *Andromeda*, *St. George*, *Gladiator*, *Sybille*, *Naiad*, *Latona*, and *Mercury*, and two destroyers and 10 torpedo-boats. The types represented by these ships are, as will be seen, many and varied. The *Europa* and *Andromeda* are sister ships, but the *St. George* is of another type of cruiser. The *Sybille*, *Naiad*, and *Latona* are sister vessels, and the *Mercury* is the oldest of the eight, although by no means to be despised now that she has received a fresh armament of modern guns. Eleven cruisers in all were sent out from Devonport, including the *Juno*, *Thames*, *Forth*, *Cambrian*, *Charybdis*, *Æolus*, *Retribution*, *Rainbow*, *Sirius*, and *Spartan*. Two destroyers and seven torpedo-boats also hoisted the pennant at this yard. From Chatham Dockyard 11 cruisers and seven torpedo-boats assembled to take part in the manœuvres. These included the *Argonaut*, *Vindictive*, *Minerva*, *Diana*, *Brilliant*, *Apollo*, *Andromache*, *Sappho*, *Terpsichore*, *Mersey*, and *Arethusa*. Of these ships the last-named is the slowest, as she is only able to steam at 16 knots speed, whilst the *Argonaut* is able to cut through the water at a speed of 20·5 knots. Although such a number of vessels have been commissioned, there are still a great many left at the dockyards, and the demand occasioned for men by these vessels hoisting the pennant did not, as was prophesied would be the case, leave the dockyards empty as regards seamen; as at Portsmouth for instance, after all the vessels commissioned there for the manœuvres had left, there were still some 4,000 men to spare. On the whole the machinery of the newly commissioned vessels acted very satisfactorily, although it is now two years since a partial mobilisation of the Reserve took place. Only one ship failed to be ready on the evening of the 11th of July, owing to the disablement of her steam capstan. Several of the torpedo-boats had to be put back for repairs owing to bad weather being encountered, and two of the destroyers exercising at Stokes Bay collided. But these mishaps are expected, and in fact anticipated, for spare boats and spare gear are always kept ready in case of such accidents happening.

The "General Idea."

War began the last week in July, and is to be kept up until the 5th of this month. Officially defined, the "general idea" is as follows:—"A British convey (C) of slow ships escorted by a fast cruiser, on passage from Halifax to Milford Haven, is ordered to await at a certain rendezvous the arrival of a protecting squadron. N.B.—The slow ships cannot be taken in tow, must remain in company, and have no fighting value. A hostile squadron (A) of fast ships, lying at Belfast, is sent to intercept and capture the convoy and bring it into Belfast. After an interval, a superior British squadron (B) of slower ships is sent to protect the convoy (C) which has been ordered to a prearranged rendezvous, cover it from the hostile squadron, and bring it into Milford. The whole of Ireland is hostile territory, and belongs to "A." The coast of England and Wales from the Island of Islay to the Lizard, including the Scillys and the Isle of Man, is British territory. The hostile fleet (A) has torpedo boats at Waterford, Kingstown, and Belfast. The British fleet (B) has destroyers at Milford Haven, Holyhead, and Lamlash. Generally the idea may be said to be a good one, and provided no "holes" have been left in the rules of the game which flag officers could take advantage of, and render the manœuvres fruitless, some first-class lessons in naval strategy should be gained. The advantage possessed by "B" fleet is that, although slower than "A" fleet, it is stronger, for, however fast a fleet may be by itself, it would have to accommodate itself to the speed of the slowest vessel with which it is keeping company, and therefore the capture of the convoy "C" by "A" fleet renders it slower than "B" fleet, which if it manages to come up with the enemy in charge of the captured convoy, should make good use of its superior strength.

The Objects of the Manœuvres.

The principal object, we are told, of the manœuvres this year is to obtain information as to the most advantageous method of employing a considerable body of cruisers in conjunction with a fleet. A subsidiary object is to throw some light on the relative advantages and disadvantages of speed and fighting strength. Another subsidiary object is to obtain information relative to the working of destroyers and torpedo-boats. The most important lessons learnt from the above will be in connection with systematic scouting, for which such a great number of cruisers have been commissioned. Attempts have been made in former years to throw some light upon this question, but that very little was learned will be seen when the failure of the American scouts, who were sent to look out for Cervera's squadron, is recalled to mind. A great deal of interest, too, centres in the operations of the torpedo craft. These vessels will, no doubt, have to perform a good deal of hard work before the war is finished, and the provision of so many spare boats ready for sea shows that doubts are felt as to how these delicate vessels will stand this hard work. The employment of destroyers as torpedo-boats in the manner indicated in the "general idea" should give us a practical demonstration of their value, and settle the discussion raised some time since as to the advent of the torpedo-boat destroyer sounding the death knell of the battleship. Up to now the machinery of the newly commissioned vessels has given little trouble, or at any rate, the engineer officers have managed to keep the vessels going. Fleet "A" is commanded by Vice-Admiral Sir Harry Rawson, and consists of eight battleships, three first-class, 14 second-class, and two third-class cruisers, with 28 torpedo-boat destroyers and three gunboats. Fleet "B" is commanded by Vice-Admiral Sir Compton Domvile, who has under his command 10 battleships, four first-class and 16 second-class cruisers, in addition to 24 torpedo-boats and three gun-boats. He has also, of course, the convoy of two slow vessels under his charge.

Portsmouth Dockyard.

The departure of the ships which were made ready at this yard to take part in the manœuvres did not make much difference in the amount of work usually carried on. The repairing basin was cleared out, with the exception of the gunboat *Excellent*, and at the depot and in the gunnery and torpedo schools there were, of course, fewer hands. But there are still 4,000 men at work or at drill in the depot and gunnery and torpedo schools. Further reports are to hand of the failure of the patent fuel experimented with in the *Surly*, and one result, which ought to be enquired into, is that some of the men who were assisting in the discharge of the last cargo of compressed coal-dust briquettes have had their eyes affected by the work. The trials of the battleship *Canopus* will probably take place early this month, but if they are postponed, as has been done several times previously, no surprise will be felt. The cause of the delay is that the engines of the *Canopus* are not yet ready. Very little progress is being made with the new Naval Barracks. At least, this is the impression conveyed to an outsider. Some 500 men have been at work pulling down the old buildings, and when the tons of brick and rubbish have been cleared away, the work of building the new barracks will be commenced. The *Narcissus* lies in the steam basin here ready for overhaul. Her refit, which is not to be taken in hand just yet, is estimated to cost about £20,000.

Two New Warships Launched.

On the 25th ult. the first-class battleship *Vengeance* took the water, her launch being carried out in the successful manner characteristic of the firm of Vickers, Son & Maxim, where she was built. The *Vengeance* is to have a displacement of 12,950 tons, and is built almost entirely of steel. Her length is 390 ft., beam 74 ft., with a draught of 26 ft. She is to cost £814,619. The armament of the new battleship is to be four 12-in., twelve 6-in. quick-firing, and twelve 12-pounders. She is to have a complement of 750 officers and men, and is to be able to steam at 18·25 knots under natural draught. The cruiser *Pioneer* was successfully floated out of dock at Chatham earlier in the month. The christening ceremony was performed by Miss Andoe, daughter of the admiral-superintendent of the yard. The *Pioneer* was begun on December 16th, 1897, and the weight of the vessel at the float-out was 1,500 tons. The *Pioneer* is a sister to the *Pelorus*, and has the following characteristics:—Length between perpendiculars, 305 ft.; breadth extreme, 37 ft.; draught of water, forward, 12 ft.; aft, 15 ft.; displacement, 2,215 tons. She is to be fitted with four-cylinder inverted, vertical triple-expansion engines and eight boilers of the Thornycroft water-tube type. The I.H.P. is to be 7,000, and the speed anticipated with this power is 20 knots. She will have a coal storage at normal draught of 540 tons, and carry 224 officers and men. Her armament is to consist of eight 4-in. quick-firing, with eight 3-pounder Hotchkisses and 3·45-in. Maxims.

Novel Methods of Ship Communication.

Public as well as professional interest has been roused by the statement that the *Juno*, one of the vessels taking part in the mimic fighting now in progress, is supplied with a special Marconi apparatus for the purpose of receiving and sending telegraph messages without the aid of wires. For several years past the torpedo officers of the Navy have been experimenting in wireless telegraphy, and Captain H. B. Jackson, of the torpedo school-ship *Defiance*, has invented a system which is at all events equal, and probably superior, to that of Signor Marconi. It was therefore amusing to be told by some of the daily papers that Commander Nicholson, of the same ship, had "mastered the principles" of wireless telegraphy, and had therefore been selected by the Admiralty to embark in the *Juno* for the purpose of watching the experiments with the Marconi system and reporting upon them. The reason that the Admiralty has not been as keen in taking up Marconi's invention as the French naval authorities is probably because it has some faith in the efficiency of Captain Jackson's idea. Another novel method of communication between ship and shore is the use that is to be made of carrier pigeons. The birds are to be used chiefly in connection with the torpedo flotilla exercises, as it is evident that they would not be of much use as a means of communication between the cruisers and the fleets for which they are scouting, for it is not likely that the birds would reach home if liberated more than a couple of hundred miles from shore.

Devonport Dockyard.

The fact that Plymouth has been made the headquarters of the torpedo-boat flotilla during the Naval Manœuvres has afforded visitors to this place an interesting sight and one not often witnessed. Captain Hamilton certainly deserves praise for the great amount of trouble he took to make his fleet efficient. Several of the boats developed slight machinery defects, but every case was attended to in less than 12 hours, and this, it must be admitted, reflects some credit on the engineering staff at this yard, and more especially, as with the exception of three, all the boats are about 15 years old. An order has been received at Keyham Factory for the manufacture of boiler tubes for the torpedo-boat destroyers *Fame* and *Whiting* on the China station, and the *Foam* on the Mediterranean station. The Admiralty in this manner show that they appreciate the work previously done at Keyham in this direction. It is worthy of mention here that probably at the end of this month the *Fervent* and *Zephyr*, a couple of torpedo-boat destroyers ordered from Messrs. Hanna, Donald, & Wilson, at Paisley five years ago, will be delivered at this yard. It will be remembered that they failed to obtain the guaranteed speed on trial, and have had to be reboilered. Their maximum speed is to be 27 knots. The preliminary trials with the boats have proved successful, and there is little doubt that the official trials on the Clyde will turn out equally so. The *Implacable* and *Bulwark*, now in course of construction here, are to be fitted with as much non-inflammable wood as possible. The cabin doors and bulkheads are to be made of the new wood, and now that the Admiralty have decided to use it in these vessels, it is probable that in future new ships will have a large number of their permanent fittings, which are now made of steel, constructed of non-inflammable wood. Considerable satisfaction has been expressed with the result of the trials of the *Highflyer*, and although the *Hermes* rendered such a good account of herself as regards her steaming powers, the *Highflyer* has beaten her.

The Royal Dockyards Reorganisation Scheme.

The advantages anticipated by the new scheme of organisation sanctioned by the Admiralty in reply to the dockyard subordinate officers' petitions simplifies matters all round, both as regards officers and men. The wages to be paid for definite work done at the yards is made clear, and it will now be practicable to modify the scheme rates from time to time as experience, improved methods, &c., may necessitate. According to the new reorganisation scheme, which is to take effect from the commencement of the present financial year, the principal changes brought about will be as follow:—The three existing grades of supervising officers, viz., in the case of shipwrights, inspectors on salary, and chargemen of day pay, and, in the case of other trades, leading men and chargemen, are to be ultimately replaced by two grades—inspectors of shipwrights and of other trades and chargemen. The ultimate staff of inspectors of the several trades and their salaries are to be:—Shipwrights, £130 to £170; hydraulic work, £130 to £170; joiners, £110 to £150; ship and electrical fitters, £130 to £170; plumbers, £105 to £115; painters, £100 to £130; caulkers (wood), £110 to £140; engine fitters, £130 to £170; boiler makers, £130 to £170; boiler makers (Sheerness, charge pay in addition), £30; coppersmiths, £130 to £170; founders and pattern makers, £130 to £170. The existing inspectors of shipwrights who have been three years at the maximum of the present scale, and who are appointed under the new scale, are to be granted an immediate increment on that scale, whilst the salaries of those who have been recommended for the new class, but are now drawing less than the new minimum, will be raised to that minimum. The men will now be able to see exactly how much they earn according to the work they do. Previously this was not the case, and there was consequent discontent on the part of those who could not follow the old schemes.

Smart Coaling Feats.

The evolution of coaling ships always calls forth a good deal of competition, and during the month some exceptionally smart performances have been made by some of the ships of the Channel Squadron. The most noteworthy is that of the *Diadem*, which a couple of weeks ago eclipsed all her own previous records, and almost beat the record made by the *Majestic* at the beginning of the month. The *Diadem* had 1,500 tons of coal to take on board, and managed to complete the task in five minutes less than 15 hours, making an average of something over 100 tons an hour. Coaling was commenced at five o'clock in the morning, and although some delay was experienced, owing to the continual breaking down of the steam winches of the collier alongside, the operation was finished by 9.15 p m. the same day. Out of this time one hour and twenty minutes was taken up for meals. The Admiral at the Nore complimented the *Diadem* on her smart feat. Earlier in the month the *Majestic* took in 1,300 tons of coal in ten minutes under fifteen hours. The same ship had previously coaled at the rate of 161 and 172 tons an hour, but for so large a quantity, and having regard to the fact that the coal was shipped on one side only, the performance surpassed any previous record, Apparently, the ships of the Mediterranean Squadron are not so smart at the work, for the result of a coaling operation at Marmarice, in which all the battleships took part, was that the average amount of coal taken on board per hour ranged from 110 to 27 tons. However, little comparison can be made in this case, as the ships took in coal from the colliers, and the first ships to coal had, of course, an advantage over those that cleared the colliers.

Chatham Dockyard.

The 18 vessels commissioned here for the manœuvres were made ready for sea without the least confusion, although the yard generally presented a busy scene. After the manœuvres are over it is expected that the *Argonaut* will be commissioned for service in the Channel Squadron, and the *Minerva* for service on the China station. The completion of the *Irresistible* is being pushed forward as rapidly as possible. She has received a great number of her armour plates, and if the contractors had been able to supply the armour plates at the proper time, every one would by this time have been in position. Messrs. Maudsley, Son and Field, the engine contractors, have now forwarded the remainder of the machinery required to complete the main engines. Special efforts are to be made to have the *Irresistible* ready for her steam trials early next month, and she will probably hoist the pennant in the commencement of the third month of next year. The steam trials of the *Coquette*, it may be mentioned here, did not prove as satisfactory as could be wished for, as she failed to realise the contract speed. She has undergone certain structural alterations in her boilers after having been returned to the contractors. The steam trials of the *Albatross*, *Mermaid*, and *Cheerful* are also to be carried out whilst the Reserve is away for the manœuvres. It is probable, too, that the steam trials of the *Goliath* will be carried out very early this month, if a crew can be got together for her. Her gun mountings are now almost completed, and she is only waiting for Messrs. Vickers, Sons and Maxim to deliver the gun shields. However, if these have not arrived at the time she is ready for sea, she will probably carry out the trials without them. Good progress is being made with the *Venerable*, which was laid down at the commencement of January last, and preparations are being made for the reception of the main-engine shafts. She will probably take the water in October.

The Failure of Oil Fuel.

It is to be hoped that the failure of the oil-fuel trials in the *Surly* will not cause the Admiralty to completely abandon the experiments, although it must be admitted that the task of bringing this fuel into practical use seems well-nigh hopeless, at any rate with the furnaces which are used on the *Surly*. The thick black smoke which pours out of the funnels of this vessel when the trials are in progress has not been noted in recent experimental trials abroad, and as a matter of fact, in Italy, France, Russia, and the United States, one of the chief advantages claimed for oil fuel is its smokelessness. The new ships of the Russian Black Sea fleet can burn either oil fuel or coal, and the same is the case with the *Sardegna*, *Sicilia*, and many other vessels of the Italian Navy. The Admiralty might do worse than take a hint from the Russians or Italians as to the proper way to burn oil fuel in warships.

The Trials of the "Prometheus."

The monotonous regularity with which cruisers built at the private yards successfully passed through their trials has not been broken in the case of the cruiser *Prometheus* recently delivered at Sheerness from the works of Earle's Shipbuilding & Engineering Co., Hull. The only hitch that occurred in the whole of the trials was during the gun-mounting tests. Orders were given for the anchors to be lowered; and, subsequently, when the capstan lifted the port anchor some links of the cable belonging to the starboard anchor were found to be coiled round it. The operation of clearing the cable occupied about nine hours. The 30 hours' coal consumption trial at half-power proved thoroughly satisfactory, the coal consumption being 2·01 lbs. per I.H.P. per hour, with a speed of 17·5 knots. The eight hours' natural-draught trial also turned out very successful, a speed of 19·8 knots being obtained, and the same may be said of the four hours' forced-draught trial, at which a speed of 20·8 knots was obtained. The cruiser *Highflier* also came out of a series of trials, to which she was subjected early last month, with flying colours.

Sheerness Dockyard.

The gunnery classes here have been stopped whilst the Naval Manœuvres are in progress, as it is not possible to carry them on, so many officers and men being away in the ships which have been commissioned to take part in the partial mobilisation. Vice-Admiral Sir Nathaniel Bowden Smith has now hoisted his flag as Port-Admiral at this yard, and as he has the reputation of being a "popular" man, it is, of course, probable that he will be well liked. The *Prometheus* and *Perseus* are now being prepared for the pennant, for which they will be ready some time next month. A fair amount of work is being put into the two new sloops building here, the *Vestal* and *Sheerwater*, laid down on the 1st of February last. These vessels are to be ready for launching at the end of the year, and orders were recently received directing overtime to be worked upon them. The shipwrights at work on the sister ships, *Condor* and *Rosario*, have also been put on overtime. When the *Vestal* and *Sheerwater* take the water two new ships, larger, but of a lighter draught, will be commenced. The dockyard reorganisation scheme put forward by the Admiralty has been received on the whole very favourably. In the opinion of some it is but a weak arrangement, but others consider that if overtime be not so plentiful in the future as it has been in the past, the subordinate dockyard officers will benefit very considerably by the arrangement.

Contractors' Penalties.

In the report just issued by the Public Accounts Committee, some strong remarks are made on the enforcement of penalties on contractors for serious delay in the delivery of work done for the Admiralty. A few months ago cases were pointed out where, if the penalties had been enforced, the Admiralty would have been richer by some thousands of pounds, but then it must be borne in mind that it is not always the fault of the shipbuilder that ships are delayed in delivery. Strikes and the impossibility of turning out a sufficient quantity of armour, made according to the Admiralty's liking, have much to do with it. The contractors are no doubt as anxious to fulfil their agreements as the members of the Public Accounts Committee are to keep them to those agreements. The report points out the cases of four torpedo-boat destroyers, in which the contracts provided for penalties for late delivery at the rate of £15 a day, and that up to March 31st, 1898, delays in delivery had occurred varrying from one year and three months to one year and ten months. These penalties, if enforced, would have easily wiped off the balance of purchase money which had not yet been paid, and which amounted to £33,000. The Admiralty waived the penalties, however, and the committee, although they do not at present express any definite opinion, consider that the Comptroller and Auditor-General should be in a position to report fully on all penalties incurred by, and the penalties waived in favour of, the several contractors.

The United States Navy.

So fast are ships being completed and commissioned for the United States Navy that a difficulty is now being experienced in obtaining a sufficient number of officers for them, and consequently several ships have had to be laid up which are really wanted for service. A number of vessels, including torpedo-boats and destroyers, are now approaching completion, and it is expected that in order to get officers for them the number serving afloat on each ship will have to be reduced. The new law regarding the pay of officers came into force on the 1st of last month, and up to the present no dissatisfaction has been expressed against it. The following table compares the pay received by line officers of the Navy prior to the passage of the Personnel Bill, and that which they will receive after July 1st of the present year, when the Army pay table takes effect. In all cases the retired pay is based on the highest sea pay of the grade:—

Grade.	Old Pay. Highest Sea Pay. dols.	Old Pay. Retired Pay. dols.	New Pay. Highest Sea Pay. dols.	New Pay. Retired Pay. dols.
Rear-Admiral	6,000	4,500	7,500	5,625
Commodore	5,000	3,750	5,500	4,125
Captain	4,500	3,375	4,500	3,375
Commander	3,500	2,625	4,000	3,000
Lieut-Commander	3,000	2,250	3,500	2,625
Lieutenant	2,600	1,950	2,520	1,890
Lieutenant (J.G.)	1,800	1,350	2,100	1,575
Ensign	1,400	1,050	1,960	1,470

A piece of news which will interest engineer officers on this side of the Atlantic is the fact that all vessels of the United States Navy hereafter shall be equipped with boilers of the tubular type. It has been recommended by Rear-Admiral Melville that the battlehips *Maine*, *Missouri*, and *Ohio* shall be constructed under plans that require these boilers, and the armoured cruisers and unprotected cruisers authorised last session shall also be similarly equipped. It is the opinion of Admiral Melville that experience justifies the Department in applying generally this type of boiler to the new vessels authorised.

Pembroke Dockyard.

The principal work at this yard is, of course, connected with the completion of the Royal Yacht *Victoria and Albert*, and the building of the armoured cruiser *Drake*, laid down four months since. As regards the former vessel, excellent progress is being made. A little difficulty has been experienced in getting the paint on the cabin bulk-heads, and other fittings to show as advantageously as was desired, and a number of coatings were found to be necessary before a good result could be obtained. This is supposed to be due to the action of the non-inflammable wood and to the chemical with which the wood is probably treated to render it impervious to the flames. As regards the *Drake*, which, it will be remembered, was commenced on the 24th of April last, it may be mentioned that the contract for the castings for this armoured cruiser has been given to the Steel Co. of Scotland, to which firm the wooden patterns for the cast-steel shaft brackets and stern-post have been sent off. The foundry at this yard does not boast of the plant necessary to permit the work to be carried out here.

The Perils of the Engine Room.

A little over a week ago a disastrous explosion occurred on board the torpedo-boat destroyer *Bullfinch*, resulting in the death of altogether 11 persons. It appears that the vessel had arrived at Spithead for the purpose of undergoing a series of tests prior to being taken over by the Admiralty. From the accounts published it appears that speed tests were being made over the measured mile in Stokes Bay. The engines were being run at their full capacity, when an explosion was heard, and a rush of steam came from the manholes leading to the boilers. The killed and injured were got out as soon as possible and transferred by means of a steamer launch to the cruiser *Australia*. One of the boat's crew said to a reporter that the shock of the explosion and of the escaping steam seemed as though it would rip the destroyer to pieces. Her engine-room hatches were all open, and through these the steam rose in hissing white columns high in the air. The efforts of the men on the deck at the time of the explosion to get into the engine-room were at first futile. Over and over again these brave fellows were driven back by the boiling steam, which also made its way into the open air by every crevice in the ship. It was like trying to enter a boiling cauldron, and yet the task was attempted repeatedly, with the result that several gallant fellows were badly burned. Ultimately the steam cleared away from the gangways sufficiently to enable the rescuers to make their way into the engine-room, although even then the work was difficult and dangerous in the extreme. The steam still half filled the engine-room proper, and through it could be dimly seen the bodies of the killed and wounded lying about the place. When the rescuers entered, the port engine was still working, and a large hole had been knocked in the vessel's bottom just by the starboard engine. Through this aperture the sea water was pouring in considerable volume, threatening to flood the compartment and endangering the safety of the ship. Meanwhile the port engine had been stopped and a collision mat was placed over the hole in the ship's bottom. Had this not been done very smartly, it is doubtful whether the vessel would have kept afloat long enough to get into harbour. All the men killed, with the exception of two named Ayres and Young, of Portsmouth Dockyard, were employed at Earle's Shipbuilding Co., the firm who built the *Bullfinch*. The connecting rod of the starboard engines broke and the piston knocked off the cylinder cover. The *Court Circular* of July 22nd contained the following message from the Queen:—"Her Majesty was much distressed to hear of the dreadful accident and loss of life on board the torpedo catcher *Bullfinch*." The adjourned inquest is to be held in about a week's time.

New Warships for Japan;

The Japanese Admiralty continues the policy commenced 10 or 12 years ago of building up a fleet of warships for Japan which shall be unequalled by any power in the Far East. There has just been launched at Elswick a new battleship, the heaviest ever built by Messrs. Armstrong, having a displacement of 1,500 tons. She is a little superior in H.P. to the *Majestic*, but has a slightly less coal capacity. Her length is 400 ft.; breadth, 76 ft. 6 in.; draught, 27 ft.; displacement, 15,000 tons; I.H.P., 14,500; and speed 18 knots. Her armament will consist of four 12-in. breech-loading guns, 14 6-in. quick-firing guns, and many smaller weapons. She will carry also four submerged torpedo tubes and one above-water torpedo tube, fixed in the stem. All the armament and the gun and torpedo machinery are of the Elswick design and manufacture. It has not yet been decided what type of 12-in. guns will be carried, as the Japanese authorities have determined to await the trials of a new Armstrong gun, 50 ft. in length, which is to be tested in the *Excellent* after the manœuvres. The *Hat Suse* was engined by Messrs. Humphreys, Tennant & Co., and is one of four sisters building in this country. The Japanese armoured cruiser *Yakumo* was launched the other day at the Vulcan Yard at Stettin. She has a displacement of 9,850 tons, and a mean draught of 23·9 ft. The engines are of 11,200 H.P. for a speed of 18 knots, but they can be worked up to 15,500 H.P., with a speed of 20 knots. One of the steam pinnaces to be carried by the cruiser will have two torpedo-tubes. Another interesting item of Japanese naval intelligence is the fact that the Japanese Government have placed orders with the Italian Terni Steelworks for a great number of armour plates to be made by this firm. The armour manufactured by the Terni Steelworks is said to be superior to that of both Krupp and Harvey. The arrival is reported at Yokohama of the torpedo-boat destroyer *Inadsuma*, which left Europe a month or so ago.

The French Navy.

The French Navy Department seems determined to go on with the building of submersible torpedo boats. Four of them, of the Narval type, are to be built at Rochefort, and at Cherbourg the other week the submarine boat *Morse* took the water. On the 24th of this month the battleship *Henri IV.* will be launched at Cherbourg, the *Suffren* having already taken the water at Brest a few days since. There are no indications that the French Navy puts faith in the Czar's disarmament scheme; for the estimates for next year are to be increased by about £370,000, and the French Navy League is doing all in its power to urge on the French people the necessity of a much stronger navy than France possesses at present. An outcry was raised in the French service papers recently about the defects in French warships, and apparently with good reason. The *Eclair* says that the engine frames of the ironclad *Bouvet* and of the cruisers *Lavoisier* and *Galilee* have been found to be seriously defective, owing to inferior metal having been used in their construction, that it is impossible to make repairs, and that the vessels will never attain their normal speed. The *D'Entrecasteaux*, cruiser, is said to be an out-and-out failure, and the authorities at Toulon are said to despair of her ever being rendered habitable or good for anything at all. She is as hot as a furnace, and it was found necessary before she left for Saigon to remove the powder from her magazines. There are to be no important manœuvres in the French Navy this year; and, with the exception of some steam tactics, long-distance signalling, and probably the working out of some simple tactical problems, very little will be undertaken.

Water-Tube v. Scotch Boilers.

The attack on the water-tube boiler in the House of Commons recently gave Mr. Goschen a chance to justify the action of the Admiralty in adopting this type of boiler for vessels of the British fleet. Mr. Allan initiated the discussion, but he could not produce any very new arguments against the water-tube, whilst Mr. Goschen was easily able to disprove his contention that this type of boiler is a failure. In a leader which appeared in the *Times* on the subject, the writer summarises the indictment of the water-tube type of boiler as follows:—Compared with the ordinary type of cylindrical boiler it is a large consumer of fuel, it needs the best kind of coal and distilled water for effective working, its tubes are liable to split if not kept scrupulously clean, it is short-lived, makes black smoke, and is a source of danger to those unaccustomed to its use. As the writer points out, however, good fuel and distilled water are merely questions of money, and "the fleet is not maintained for profit but for protection"; the answer to the next item of the indictment is, of course, that the tubes should be kept clean, and the other defects "can obviously be remedied by experience and training on the part of the firemen and stokers." The value of the boiler, it is claimed, is that steam can be raised more quickly with it than with any other type of boiler, a ship can be stopped more quickly, there is greater control over steam pressure, less danger to the stokers if a shell explodes in the boiler-room, and repairs are more easily effected. The truth appears to be that whilst we have yet much to learn about the type of water-tube boiler which best answers the purpose of the Navy, yet for strategical reasons, which must override all others in this connection, the water-tube type is far superior to the old cylindrical kind.

At the examination held on July 11th, 12th and 13th, the following candidate passed for extra first-class engineer, Mr. Robert Rioch, of South Shields. He was prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields. Sixty pupils have passed in the above grade from this establishment, being the highest record for any existing school in the kingdom.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

THE Experimental Department of the Institute of Marine Engineers has had some additions to the experimental apparatus during the month. Mr. Sage has, with his own hands, constructed apparatus for demonstrating the laws of fluid friction. It will be used to prove that the intensity of pressure on the sides has no influence on the friction of fluids when flowing through a pipe. There are two tanks, cylindrical and vertical, and these are connected at the bottom by a long copper U tube. The water stands at a higher level in one of the tanks than in the other, and the friction is measured by the time taken for the water to flow from the one tank to the other. The fastenings of the seams of the tanks Mr. Sage has neatly made with rivets, and the construction of the copper tube leaves nothing to be desired. The apparatus is a valuable accession to the Experimental Department of the institution. Mr. Sage has also made a further contribution, which will provide all that is necessary for the new experiments to be made on forced draught.

Mr. Blelloch has presented a tank. Water in it can be supplied from it at a constant height for experimental purposes. It has been of the greatest service in almost all the experiments which have been made. The water can also be regulated so that it can flow through any tube at a given velocity. When under trial the water has been measured, and runs with wonderful regularity.

Mr. Blelloch has also constructed for the institute a pyrometer in shape like a calorimeter for measuring the temperature of a flame from any gas or fire. There is first an inside copper vessel covered on the outside with asbestos. Water is placed in this vessel. It is supported from the bottom on copper rods, and kept in the middle by copper rods projecting from the sides of an outer cylindrical copper vessel. The outer vessel has a copper cover, through which is inserted a thermometer. Suspended from the cover is also a platinum wire, carrying a small piece of copper. The inner vessel is thus insulated from cold by an asbestos cover, and next by air between the two vessels. The small piece of copper is placed in the flame, and then suspended in the water of the inner vessel. It raises the temperature of this by an amount shown by the thermometer. This rising of temperature of the water gives a measure of the temperature of the flame. Allowance is made for the rise in temperature of the vessel itself.

Mr. Brown has presented the institute with a small copper boiler for the purpose of supplying steam for experimental purposes. This will be permanently fixed in some place, and the apparatus requiring steam for any special experiment arranged round it. He has also given a copper spiral which can be heated, and when the steam is passed through, it is superheated. Mr. Brown has besides given a small copper tank with a regulating cock at the bottom.

There is also now in the institute a full set of apparatus for testing oil. The specific gravity can be obtained and the fractional distillation made, also the flash point and the calorific value of the liquid fuel. Determination of those values have been obtained for Borneo oil supplied to the institute.

The further experiments promised to investigate the influence of the velocity of water in tubes subjected to heat on the outside have been made and published in *The Engineer* of July 7th. The results of those in which the source of heat was Bunsen flames were even more remarkable than those in which the source of heat was steam. There is the same kind of rise of absorption measured in thermal units as with steam and there is a maximum point as before. But the fall after a critical velocity is more deliberate and pronounced. The shape of the curve is like a heat or expansion curve. One feature comes out very clearly, that is the dependence of the critical point on the quantity of the heat supplied. Sometimes the gas to the Bunsen burners was supplied in small quantities, in other cases it was supplied in great quantities. The effect of the change was to push further forward the maximum point. It came at a higher velocity the greater the quantity of heat supplied. To give an example. When the gas for the burner was supplied by one pipe and the supply limited at that, the maximum thermal units absorbed by the water were 9,075, and the speed of the water was measured by 110 cubic centimetres per minute; when more gas was supplied the maximum was 16,200 and the speed 200; and when as much gas as could be sent into the burner was used, the maximum was 21,360 thermal units, and the speed of the water when absorbing this quantity was measured by 480 cubic centimetres.

Mr. Fell has kindly given further apparatus to go a step farther in the investigation of this wonderful problem of circulation. The point to be determined is this. It will have been noticed that the temperature of the water taken into the tubes was the ordinary temperature of water in the mains. Now, this is not quite the condition of things in a boiler. We want the water boiling first before it is sent into the tube being heated, and then measure the evaporation which goes on. This evaporation may or may not be affected by the velocity of the water through the tubes; and there may or may not be a maximum point for some particular velocity of the water moving through the tube. Anyway, that is the problem to be settled by the apparatus kindly presented to the institute by Mr. Fell.

Meldrum, it is known, gets his forced draught by using steam from the boiler to induce a draught which is forced under the grate. A great quantity of steam is used and it appears to be wasteful, but very many of Meldrum's forced-draught apparatus have already been fitted on boilers throughout the country. It is possibly due to its simplicity, in spite of its wastefulness, that it is so popular. Another system, Gosling's, illustrated in our July issue, is getting widely taken up. Some recent trials with it in Scotland show its advantage when dealing with very bad coal. The evaporation was very excellent indeed with coal only costing 2s. 11d. per ton.

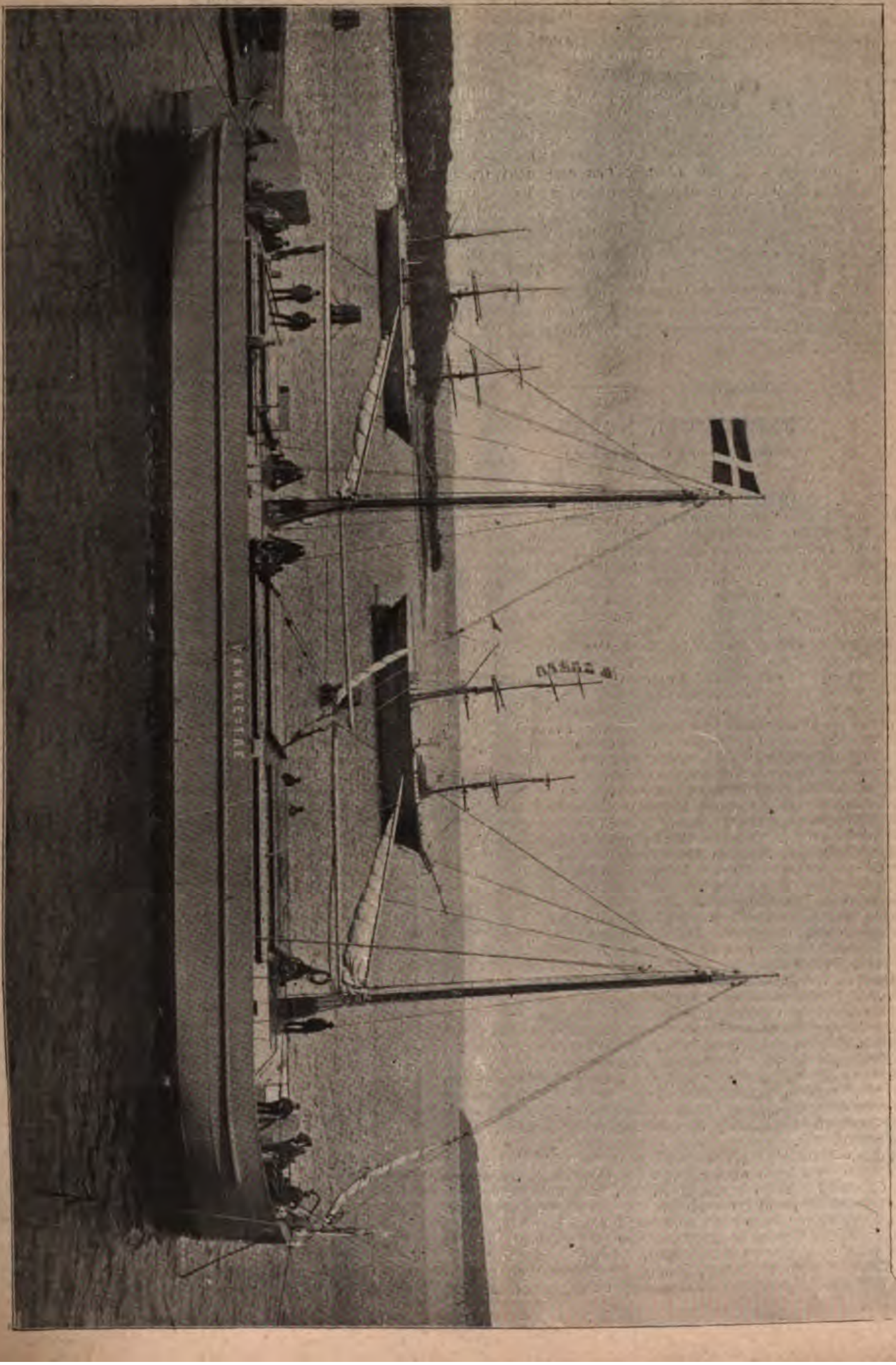
To marine engineers out on the India and China coast, it will be interesting for them to learn that two large steel river boats are to be built on the same system as the American Mississippi river boats, with large raised houses on deck from fore to aft, to ply twice weekly between Shanghai and Hankow, a distance of 690 miles. It will be a mixed goods and passenger traffic. The steamers will have twin-screws and triple-expansion engines, and they will make 12 knots an hour when fully laden. The steamers are to begin operation this month, and will sail under the German flag. The fuel is to be petroleum, and large storage tanks with a capacity for 90,000 tons are to erected on the Chinese and Indian coasts.

The institute apparatus for testing coal, presented by Mr. Macfarlane Gray, is contained in a nicely fitted box. Mr. Mather has been good enough to offer to make a similar box for holding and protecting the apparatus for testing liquid fuel.

The following is a list of the experimental apparatus in the Experimental Department of the institute:—

Description.	Presented by
1. Coal testing apparatus	J. Macfarlane Gray.
2. Radial valve gear model	R. Bruce.
3. Slide valve adjusting indicator ..	W. W. Wilson.
4. Sectional model of steam engine with Joy's gear	Jas. Stark.
5. Apparatus for circulation of water through annular tubes	Joseph Hallett.
6. Apparatus for testing the transmission of heat at different velocities of water	The Editor of the *Engineer*.
7. Water tank with fittings	J. Blelloch.
8. Tube for transmission of heat with hot gas as source	J. Blelloch.
9. Tools. Purchased	
10. Fluid friction apparatus	S. C. Sage.
11. Forced-draught apparatus	S. C. Sage.
12. Pyrometer	J. Blelloch.
13. Liquid fuel testing apparatus ..	
Box for holding liquid fuel apparatus	A. H. Mather.
14. Anemometer (on loan when wanted)	Jas. Adamson.
15. Apparatus for determining the influence of velocity of water at boiling point	W. Fell.

Marine Engineers' Examination.—At the quarterly examination of extra first-class engineers, held in July, Liverpool takes the lead this time again, and Messrs. Wm. A. Bryce, George H. Prockter, and Wm. T. Phillips were successful. The three candidates were prepared for the examination at Pritchard's Marine Engineering Academy, 8, Walton Road, Liverpool This makes 13 successful candidates at this academy for the last 18 months.



New Steel Lighter for Self-Trimming Purposes, built by the Flensburg Shipbuilding Co.

NEW STEEL LIGHTERS FOR SELF-TRIMMING.

(Patent, BREDSDORFF.)

WE show herewith a photograph of a steel lighter built for self-trimming purposes by the Flensburg Shipbuilding Co. It is a patent of Mr. Th. Bredsdorff, managing director of the said company. The dimensions of the *Danske-Tre* are 128 ft. by 30 ft. 1 in. by 9 ft. 3 in. depth, moulded, and the carrying capacity is 550 tons. The Flensburg Shipbuilding Co. has already delivered two lighters built on the same principle, but in a smaller size, and has three others of similar dimensions in stock. The owners of these lighters—the Danske Damper og Lægter Kompagnie, in Copenhagen—are full of praise of this system, and they are using them for the trade between all ports of the Baltic.

ELECTRICAL NOTES.

(From our own Correspondent.)

MR. H. HERBERT describes an invention in *l'Electricien* for prevention of collisions at sea. Two or more thermopiles are mounted on a vertical shaft, capable of rotation. These are shielded to exclude air currents and radiations from the ship, and from the sun, whether direct or by reflection from the surface of the water. The thermopiles are supposed to receive radiation from the approaching ship, and actuate relays of the d'Arsouval galvanometer type, ringing a bell when pointing in the direction of the approaching ship.

The Refrigerating plant of the Manhattan Refrigerating Co.'s New York Storage has many electrical fittings. The refrigerating medium is brine circulated by steam pumps. The brine and water pumps are worked in pairs by 20 H.P. belted motors at 250 volts, and these have to work in the wet. Switches and contacts are silver-plated to prevent chemical action with the salty atmosphere. Lampholders are of the porcelain waterproof type, hung by twisted cable from the outlet boxes. An enclosed switch, consisting of a glass tube stoppered at both ends, and containing a globule of mercury, when tilted in one direction, causes the mercury to join the iron terminals which pass through one of the stoppers. Motor fans to the number of 40 maintain the temperature throughout the storage room.

Westinghouse Electric Co.—The ramifications of this firm in America are so well known that we need only allude to it. But the company has decided and completed its arrangements for constructing works in England, and it is intended that within twelve months they shall be in full operation manufacturing electrical machines and steam and gas engines. The firm in England will bring over with it all the rights of the patents held by its sister in Pittsburg. The assistance of the staff of the firm in the New World will always be at the disposal of that in the Old. The old firm devotes at the present time one-fourth of the profits to research work. It is intended that the double firm will cater for the manufacture of steel and iron work for the British Empire, and it is said that similar works will be formed in France, Russia, and Germany. In all of them there will be the same governing power and the secret of the American success, complete standardisation, will be aimed at throughout the whole manufacturing system. British manufacturers will now have an opportunity of studying American methods at their own doors.

Volta.—Who has not heard in school (and everyone in England has been at school) of the frog's leg experiment discovered by Galvani? Volta heard of it, too, just about one hundred years ago, and he used the frog's muscle as an electroscope to discover the existence of small electric forces. With this crude instrument he discovered the properties of the pile and voltaic cell, and on March 20th, 1800, he wrote to Sir J. Banks, of the Royal Society, London, describing the pile. To commemorate this important discovery an exhibition is being held at Como, the birthplace of Volta. Volta was born on Feb. 18th, 1745. In 1774 he was appointed professor of physics in the Gymnasium of Como. In 1779 he was appointed professor of physics in Pavia. Napoleon, in 1801, called him to Paris to show his experiments on contact electricity. In 1819 he retired to his native town, and died on March 5th, 1827. The exhibition has been entirely destroyed by fire. Daring efforts were made to save the Volta memorials: the picture of Volta showing his battery to Napoleon and the sword of honour presented to him by the latter were rescued; but the only authentic portrait of Volta, his will, his valuable MS. and books, and his original battery were destroyed. The value of the exhibition was about £500,000.

The Maxim Incandescent Lamp.—Some time ago it was announced that Maxim had improved his lamp to such an extent that there was at least a saving of 25 per cent. in the number of watts required per candle. It is now announced that not only has this saving been made, but a manufactory is in course of construction in which 6,000 lamps will be made per day. The consumption of the lamps is from 2·8 to 3 watts per candle, as against 4 to 4·5 watts in the ordinary lamps.

The efficiency of Man as a Heat Engine.—Man eats and drinks and takes in energy by his food and gives it out again in the form of work by his hands or by walking. But there is much waste in the heat of the air of the breath, perspiration, &c. Dr. Marcet and Mr. Floris have been investigating the subject and have written a paper, read before the British Royal Society, where they show that the efficiency of man as a machine is a little less than 20 per cent. This is far above the efficiency of the ideal Carnot heat-engine with its boiler.

The Nernst Lamp.—The Nernst lamp is being made by the Allgemeine Elektricität-Gesellschaft in 25, 50, and 100 candle-power sizes, with a life of 300 hours and an efficiency of 1½ to 1¾ watt per candle power. The wholesale manufacture of 110 and 220 volt lamps will be commenced as soon as the new works are erected and completed.

The Bryan Marsh Co. have been experimenting with incandescent lamps. Incandescent lamps are greatly superior to arc lights in a fog, since the yellow rays of the incandescent light are not so easily damped out and absorbed as the rays of the arc light. The company have made a lamp of 5,000 candle power with two filaments, each taking 236 volts and about 3 watts per candle. The lamp thus took about 15 kilowatts. It burned out in three nights, due probably to the intense heat at the neck.

Electric Cranes.—Mr. Walter Pitt has read a paper at the conference at the Institution of Civil Engineers on "Cranes and the Power to be used with them." He compared steam, hydraulic, and electric power. The overhead traveller may be operated by a single motor or by three motors. The single motor runs continuously, and the different motions are obtained by means of belts or friction clutches. With three motors, each motor is geared to its own motion, and the type used on tramways may be introduced which have large starting torque. Liquid resistance has been used for controlling three motor cranes, but tramway controllers have also been introduced. In the three-motor crane with their series winding, the large current, says the *Electrical Review*, passes round the magnets at starting and so strengthens the gap field when the armature reaction is greatest, preventing sparking. There is no gearing, and the efficiency is necessarily greater than that of the single motor. Liquid resistances they regard as a makeshift.

India-rubber.—The manufacturers of india-rubber have good news from the Soudan. Sir William Garstin has sent in a report which has been received at the Foreign Office that on the White Nile the india-rubber creeper is found in great profusion. The plant has large laurel-shaped leaves and a white flower resembling a jasmine. He advises that the Assam india-rubber tree should be transplanted on the banks of the White Nile, and adds that, although the tree takes from twenty to thirty years to arrive at a girth sufficient to permit of regular tapping, its yield, which is about £3 per tree per annum, is so valuable that it is well worth attempting The ebony tree is also found on the Blue Nile and in the vicinity of the Sobat River. The trees from which white and red gum are taken are plentiful, iron ore is found in the Bahr-el-Ghazel, and gold mines are worked south of Fazogl.

Canal Boat Haulage.—A new system of haulage has been adopted in Belgium. It consists of a vehicle like a tricycle, to which is attached by an ordinary towing rope the canal boat. The vehicle runs along the bank, and takes the current from two overhead conductors strung by the side of the towing path. In Germany still another system is to be tried, which will consist of an electric locomotive running along a narrow-gauge railway, the necessary current being taken from an overhead trolley. Another system recommended by *Electricity* (New York) consists of electric motors running on cables carried on posts on the banks, and to which the boats are attached by two ropes. The motor may be controlled from the deck by means of two wires.

THE NOTTINGHAM UNIVERSAL AUTOMATIC FAIRY BOILER-FEEDER.

WE illustrate in the adjoining diagram a neat and compact design of an injector of the automatic type, which is manufactured by Messrs. Smith & Wilford, of the Great Central Injector Works, Queen's Road, Nottingham.

The main features of the design are:—Firstly, the suction, forcing, and delivery cones are formed in the same casting; secondly, the provision of a valve so arranged as to automatically close the vacuum chamber without interfering with the overflow passage; and, thirdly, the general arrangement of these parts and the steam cone with the outer casing whereby all the working parts can be removed and replaced in a simple and expeditious manner.

It will be seen from the illustration, of which Fig. 1 is an outside elevation, and Fig. 2 a sectional elevation, that the outer casing of the injector is divided into three chambers—viz., an inlet chamber, a vacuum chamber, and an overflow chamber, and that it is provided with four branches having connecting unions. The steam cone is fixed in the upper orifice and the combined cones are in the orifice opposite the steam cone. The right-hand orifice carries a guide for the vacuum chamber valve, which has a seat on the side of the vacuum chamber, the guide being, of course, formed to permit the passage of overflowing liquid. The left-hand orifice is connected to the liquid supply, and opens into the inlet chamber. The combined cone which passes through the vacuum chamber has openings into that chamber and into the overflow chamber.

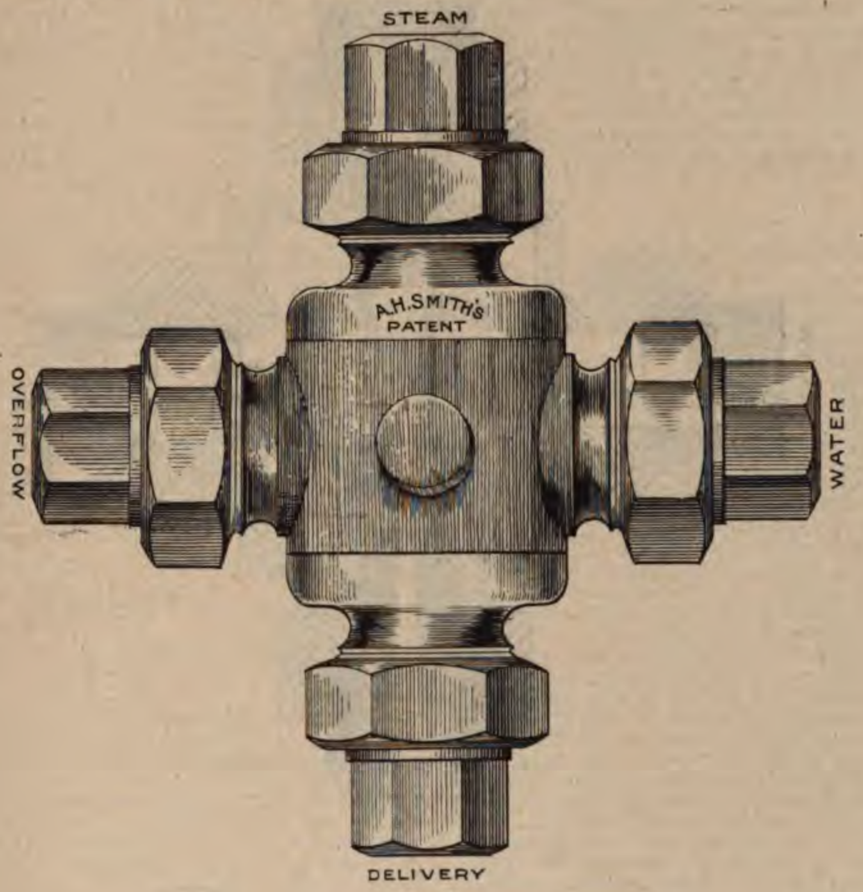


FIG. 1.

The steam and combined cones are mounted in the casing by means of screw threads, so that their relative position may be readily adjusted in accordance with the usual practice, and their final position is maintained by the pressure of the nipple of the union connection through the medium of the usual jointing washer.

It will readily be understood that the injector is automatic in its action; that the three cones, being formed in one piece, can be easily removed for cleaning and inspection; and that by the arrangement of the valve in the vacuum chamber the air and steam can escape in starting, and the chamber be closed automatically, when the injector starts to force the liquid, without interfering with the overflow passage.

The general simplicity and neatness of design should, we think, commend this injector to the notice of users of this type of water-raiser or forcer.

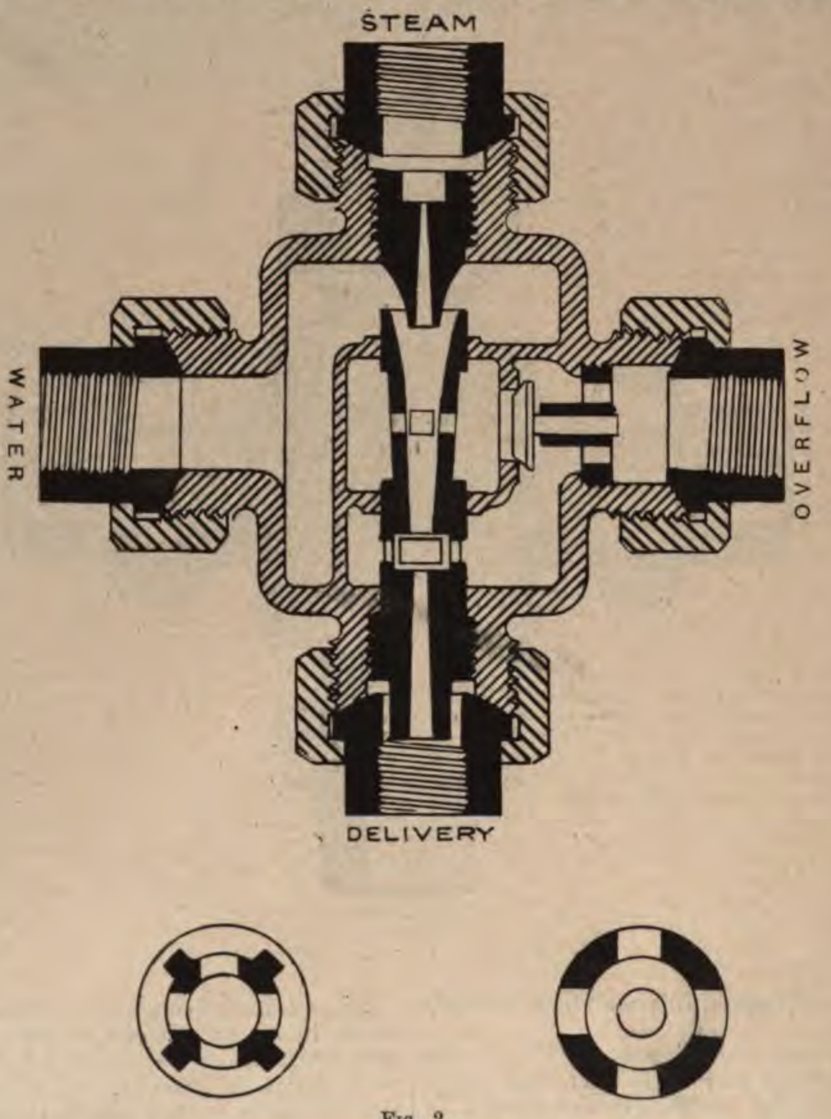


Fig. 2.

The Nottingham Universal Automatic Fairy Boiler-Feeder.

THE NEW UNION DRY DOCK AT LIMEHOUSE.

THE opinion has often been expressed for some years past that shipbuilding and ship-repairing is leaving the river Thames, and is going to the North and the East Coast, but the ceremony at which we had the pleasure of being present on July 22nd certainly afforded good evidence that the above statement is neither true in substance nor in fact. We refer to the opening of a new large dry dock in place of one previously on the same site by Messrs. Fletcher, Son & Fearnall, of Union Dry Docks, Limehouse.

The firm of Fletcher's is, of course, and has been for many years, a household word by the riverside, the original William Fletcher having established himself at Shadwell as a ship repairer in the 17th century. It is an interesting fact to note that in the 18th century the whole of the Isle of Dogs could hvae been bought for £10,000, and that a long lease could have been secured at a low rental of a very large portion of it. What a different aspect has been created in something a little more than a century, judging from the large number of extensive and successful commercial undertakings that are now crowded upon the island, and the thousands of residences which now exist for the working population employed in the industrial concerns now carried on.

The opening of the present dock illustrates very forcibly a forward step in engineering, inasmuch as it takes the place of a dry dock constructed in 1818, which can unhesitatingly be described as unique. It was at the time of the making of the Shadwell entrance to the London Docks that the proprietor, Henry Fletcher, found his then premises were compulsorily acquired, and he had to migrate elsewhere. He therefore secured the present premises at Union Docks, which he proceeded to extend. There had been for many years a breach in the river just below the two Union Docks and contiguous to them, and he endeavoured to construct a third graving dock.

The nature of the ground, however, making it an unexpectedly difficult undertaking, owing to a bed of quicksand, he purchased an old East Indiaman, called the *Canton*, sank her, fastened her down with through piles, erected gates at her stern, and formed a unique dry dock, which for 70 years, in fact until 1898, formed the third, or lower dry dock. When the extension was decided on in 1897, after consultation with the pilots, it was decided to excavate the dock at an angle of 45 deg. to the river, so that the most favourable position should be secured for dry docking on the flood tide. This meant the sacrificing of the old dock, and naturally the *Canton* had to be removed. This proved, as was to be expected, a formidable matter: the vessel, although over a century old, was built of English oak of heavy scantling, and was found to be in a perfect state of preservation, and so tough that each timber had to be split out.

The new dock was designed by the well-known engineers, Messrs. Kinniple & Jaffray, and the contract was secured by Messrs. Kirk & Randall, who started work on September 30th, 1897. It is 440 ft. long, 79 ft. broad at the coping, 60 ft. at the entrance, and is of concrete throughout, the bottom being pierced at every 10 ft. by 4 in. iron tubes to enable any possible future erosion in the ballast being made good by stock-ramming with clay or cement grouts. Danger of flotation, arising from an accumulation of water behind the walls, has been met by the insertion of a sufficient number of 4-in. pipes in them at the proper height to relieve the pressure. The pumping machinery is gas-driven, and in duplicate, developing some 340 H.P., capable of emptying the dock in from one to two hours. The engines were supplied by Messrs. Crossley Bros., Limited, and the pumps by Messrs. Gwynne & Co. The company have also provided, ready to leave at the shortest notice, a salvage plant consisting of two steam salvage pumps with interchangeable parts, and a craft provided with sleeping accommodation for the hands and their supervisors.

The ceremony of opening the dock was carried out by Mr. R. G. Fletcher and his party entering the dock at high water on board his steam yacht *Sweetheart*, gaily decked out with bunting, and breaking a floral garland which was stretched across the mouth of the dock. Immediately after the opening, the first ship to be docked, the s.s. *Hollinside*, was floated in, and docked for repairs, she having 25 plates out of her bottom from running ashore in the Baltic. During the luncheon which followed the docking of the ship, the water was pumped out of the dock, so that the guests had the opportunity of seeing the ship in dry dock.

The firm of Fletcher, Limited, are to be warmly congratulated on having made this extensive addition to their premises.

Amongst those who were present, both at the opening and the luncheon, were Sir W. Fortescue Flannary, M.P., Messrs. Sidney Young (Admiralty Registrar's Court), C. F. Torrey, W. Littlejohn Field, R. McAllum (Charlton, McAllum & Co., owners of the s.s. Hollinside), M Farqueland, of Clarkson & Co., and some 200 other visitors.

Reviews.

Ocean Rainfall by Rain-Gauge Observations at Sea. By W. G. Black, F.R.M.S. Edinburgh: E. & S. Livingstone. No date.

THE observations which are here recorded and tabulated were taken in the period between the years 1864 and 1881. They are, therefore, not very recent. But, considering the subject dealt with, the fact that the records have been taken accurately is of far more importance than that they should have been taken recently. We are told in the earlier pages how and by whom the phenomena noted were observed, and are thus furnished with good data to check the accuracy of the conclusions arrived at. Some of these are necessarily imperfect, as in many cases observations are altogether wanting for certain parts of the ocean. Monthly tables of the ocean rainfalls are, as far as possible, given for the various oceans, as well as for the northern and southern hemispheres. Another set of tables furnishes us with zonal summaries. In connection with these is given an interesting chart showing by its shading the incidence of the rainfall in the various zones of the oceans of the earth. In addition, a number of diagrams are afforded, whereby the relative rainfall in the various months is shown by dotted lines.

The work, which must have been excessively laborious, cannot fail to be of great value. For, though the crops of the world cannot be affected directly by the rainfall at sea, it is impossible to obtain any precise knowledge of the conditions which affect the small land surface of the globe on which we live without having regard to the very much larger surface where there are no trees and no mountains to attract the rain clouds. The theory of winds and air currents cannot be elaborated without the accumulations of records such as now lie before us, and we therefore welcome the volume as a valuable contribution to the sum of human knowledge.

The Slide Valve Simply Explained. By William J. Tennant, A.M.Inst.M.E. London: Dawbarn & Co. No date.

THIS booklet is the second of the Model Engineer series. It was, as its author tells us in his preface, originally written for the benefit of his railway students. It is now adapted for the use of all engineering beginners who wish to obtain a clear grasp of the working of the valve which plays so important a part in the economy of engines of every type. The true understanding of the characteristics and functions of this piece of mechanism is rightly held by the author to be of the greatest importance in the foundation of knowledge of mechanical engineering. "If," says Mr. Tennant, "the beginner can bring himself to believe that the slide valve is nothing more complex than a sliding shutter with a cavity in its face, travelling backwards and forwards over three ports, the outermost of which are alternately opened and shut to steam, and placed in communication with the central exhaust port, he will have made a satisfactory commencement." To help him to realise this initial fact, he would furnish the student with the means to make a cardboard model which shall be capable of graphically dealing with the principles and may enable him to wrestle in his leisure moments with the problems which arise in his studies. The idea which is here suggested is well and lucidly worked out in the pamphlet by the aid of many diagrams, and we feel sure that its study will be very valuable to all those who are commencing their engineering education.

Know your own Ship. By Thomas Walton, 1899. London: Charles Griffin & Co.

Mr. Thomas Walton may be heartily congratulated on having written the most successful book of the Nautical Series. It is but three years since it made its appearance, and already it is in its fourth edition. The bulk of the volume has in the meantime greatly increased as experience has made clear to the author how far the general readers of his work wish to go in their knowledge of the characteristics and behaviour of the wonderful machine in which they spend their working life. A new chapter on Trim has been added to the original book, this chapter embodying the points of a paper, which, under the same title, was read in March, 1898, before the Shipmasters' Society of London. The chapter on Stability occupies a great part of the book, and, indeed, it is one of the most important subjects to which the attention of the modern seaman can be turned. Section 3 of this chapter deals with that important phase of the question which comes under the head of ballasting. As Mr. Walton truly says, want of knowledge on this point has led to the loss of many a fine ship. As the size of steamers and their depth increases, the importance of this question seems to increase also. Some remarks are made as to the position of the registry offices in regard to this point. Referring to the common phrase, "cellular double bottom all fore and aft for water ballast to Lloyd's requirements," he points out that this does not in any way mean that the arrangements for ballasting the vessel are at all approved by Lloyd's, or any other similar body. No registry society touches on the important point as to whether or no the provision for ballasting the ship be proper. All they do is to certify to the strength of the receptacles, if any, provided for the water ballast, and say nothing as to whether or no they may be sufficient in capacity for their purpose. He is careful to explain that he says this not to find fault with the registry societies, who are clear enough to understanding people in their explanations as to what they consider their functions. But he dwells on the matter because he wishes to point out the error of those headlong people who will not, or cannot, understand what they read, and who rush to conclusions that because something is said about one aspect of a ballast tank, that must be taken to mean approval of it from quite another point of view. The chapter on Water Pressures has been very largely re-written, and the book is now one that can be most advantageously studied by every sea-going officer, whether his duties lie on the bridge or on the starting platform.

It is pleasant to learn that the author is now engaged upon another volume for the same series, to be entitled, "The Construction and Maintenance of Steel Ships." We feel sure that this volume will be a valuable addition to the library of which it is to form a part.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from June 26th to July 25th, 1899:—

Austen, E. J., staff engineer to the *Duke of Wellington*, for the *Intrepid*, to date July 8th.

Blake, A. B., staff engineer to the *Duke of Wellington*, for the *Pallas*, to date June 29th.

Cole, W. G., assistant engineer (temporary) to the *Diadem*, to date July 3rd.

Emdin, A. R., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Emdin, A. R., chief engineer to the *Pelorus*, to date July 1st.

Hearn, J. H. C., probationary assistant engineer to the *Diadem*, to date July 19th.

Huddy, T. B., engineer to the *Duke of Wellington*, for the *Vulture*, to date June 27th.

Knapman, H. T., engineer to the *Pembroke*, for the *Avon*, to date July 7th.

Manning, H. L., chief engineer to the *Pembroke*, for the *Audacious*, undated.

Michell, W. H., fleet engineer to the *Vivid*, for the *Edgar*, undated.

Odam, E. K., staff engineer to the *Duke of Wellington* for the *Fox*, to date July 7th.

Rattenbury, E. J., retired staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Shirvell, J., fleet engineer to the *Vivid*, for the *Calypso*, to date June 26th.

Smith, W. A. P., engineer to the *Pembroke*, for the *Haughty*, to date July 7th.

Stevens, W. C., engineer to the *Pembroke*, for the *Bittern*, to date July 8th.

Tregenna, H. E., engineer, has been placed on the retired list of his rank.

Webb, A. T., acting chief engineer, has been confirmed as chief engineer in her Majesty's fleet.

Wright, J. R. B., fleet engineer to the *Vivid*, for the *Bellerophon*, to date June 26th.

Yeats, H. T., engineer to the *Pembroke*, for the *Cygnet*, to date July 8th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

JULY being the great holiday month on the Clyde, the output of new shipping from the building yards is usually much below the average, and this year the July instalment will form no exception to the rule, although, at the date of writing these notes, there still remains a week to complete the period. The annual Glasgow Fair holidays began on the 14th of the month, and they were responsible for almost a clear fortnight's cessation of operations in most establishments in the upper reaches of the river. The works in the lower reaches—Port-Glasgow and Greenock—had their holiday period ten days earlier.

This year industrial Glasgow set out on its annual holiday under financial and economic conditions of the most favourable kind, and very fortunately to this was added highly favourable auspices as to weather. All classes of workmen have not only been well employed, but they have been receiving good wages. The iron, steel, coal, shipbuilding, and engineering industries of the Clyde and the whole West of Scotland were never more prosperous, nor have those directly associated with these industries received for a long time a better return for the capital invested and the labour expended. This highly gratifying situation is happily likely to exist for some time, as apart from the lull in the placing of new work on the Clyde, on which I have commented in previous issues, there is as yet no evidence of a turn in the tide of the commercial prosperity of the district. Happily, too, there is now a better understanding between capital and labour, thanks to the formation of boards of conciliation in the iron, steel, and coal trades, and the spirit of reasonableness and frank cordiality which is evidenced in the negotiations in matters of difference between employers and employed in the shipbuilding and engineering industries.

Although shipbuilding during June, and what has passed of July—as evidenced by the number and tonnage of the vessels launched—has been carried on with continued briskness, the tonnage output might well have been greater than it has, considering the number of contracts pressing for completion as well as the fact that prior to the annual holiday stoppage the workmen are steadier than at any other time. Altogether about 36,100 tons were turned out during June, as compared with 48,000 tons in June of last year, and 30,000 tons the year previous. That the present figure is only an average one may be accounted for by delays through sluggish or irregular supply of material from the steelworks which are still taxed to the uttermost and in operation night and day.

The June output was made up of 15 steamers for the merchant service, one screw gunboat for the British Government, four steam trawlers, one steam dredger, nine barges and lighters, and several small yachts. The largest steamer was the *Tagus*, of 5,500 tons, built by Messrs. Robert Napier & Sons, Govan, for the Royal Mail Steam Packet Co.; the next in point of tonnage was the *Rajah*, of 4,500 tons, built by Messrs. Charles Connell & Co., Scotstown, for the Asiatic Steam Navigation Co., Liverpool, and there were five other steamers of between 3,000 and 4,000 tons. The war vessel launched was the screw gunboat *Thistle*, from the yard of the London and Glasgow Shipbuilding Co., Govan. The June quota brings the total output for the six months of the year up to 233,000 tons, or about 25,500 tons in excess of the output for the same period last year, representing in fact an excess over any corresponding period in the history of the industry. During the first fortnight of July nine vessels were launched, aggregating 13,900 tons, the largest being a steamer of 6,700 tons from the stocks of Messrs. Scott & Co., Limited, Greenock, for the Ocean Steamship Co., Liverpool.

Whilst the tonnage output for the first half of the year reaches to an unprecedented figure, the tonnage still in hand is as yet plentiful, but the cessation in placing new work, which set in four or five months ago, is still very marked. Unless matters improve soon vacancies will begin to be evident in some of the yards. Although delivery is not now so uncertain, owners still apparently prefer to wait uncommitted till the prices of material are somewhat less than they are at present, and the chances of prompt delivery are still better. How matters stand in these connections may be judged of from the fact that more than one Clyde builder is in the position of not having bought material sufficient even for present requirements, and is holding back from doing so till the turn of the market. More than one boat in frame, it is believed, is stuck because the builder cannot afford to buy the material at present abnormal rates.

The contracts reported during June and July are:—A twin-screw hopper dredger for Japan, and a large and powerful hopper dredger for the Suez Canal Co., both to be constructed by Messrs. William Simons & Co., Renfrew; a hopper dredger for the Llanelly Harbour Board, by Messrs. Fleming & Ferguson, Paisley; two steam trawlers for the Ocean Steam Trawling Co., Aberdeen, by Messrs. Mackie & Thomson, Govan; a steam launch for an Irish owner, by the Clyde Patent Slipway Co., Greenock; a paddle-steamer for Chinese river service, by Messrs. Blackwood & Gordon, Port-Glasgow; a sailing barque of 3,000 tons for Messrs. Browne, Watson & Co., Glasgow, and two mail steamers of 18 knots speed for the Roumanian State Railways, by Messrs. Robert Napier & Sons, Govan.

The hopper dredger above noted as having been contracted for with Messrs. Simons & Co. by the Suez Canal Co. is intended for improving the entrance of the Canal at Port-Said, and she will be the largest and most powerful dredger ever constructed. She will be 270 ft. in length, 48 ft. in breadth, and 19 ft. deep amidships. She will have hopper capacity for 2,200 tons of dredging, and the bucket ladder will dredge to a depth of 40 ft. The lifting capacity of the vessel will be 1,500 tons per hour, each of the buckets lifting about two tons of material.

The order secured by Messrs. Blackwood & Gordon, Port-Glasgow, is for the hull of a light-draught steamer only, to be taken down after erection and shipped to its destination in pieces. The engines and other machinery will be provided by Messrs. Denny & Co., Dumbarton. In fact, the order has been placed with the Port-Glasgow firm by Messrs. Denny & Bros., who have for some little time had more work of this character than they could conveniently tackle. Besides having sub-contracted with Messrs. Blackwood & Gordon, and also with

Messrs. Alley & Maclellan, of Polmadie, for the completion of hulls, the firm have found it necessary to utilise surplus ground belonging to them lying outside their yard wall for work of this class, and they are now completing the erection and fitting out with machinery of new sheds alongside.

Whilst speaking of Messrs. Denny & Bros., it may be noted that Mr. Archibald Denny, one of the partners of this eminent firm, has recently been visiting the shipyards of the United States in the course of his tour round the world, which was begun in November last, when he left Scotland for Burmah. Since then he has observed shipping methods in the Irrawaddy and Bramaputra rivers, India, in which regions innumerable steamers and barges built by his firm are employed; also at Melbourne and Sydney and in New Zealand, about which regions the same remark might almost be made. Crossing the Pacific, he has visited San Francisco and Newport News, Philadelphia, Washington, &c. Mr. Denny's previous visit to Philadelphia was made in 1882, and he has remarked wonderful progress as regards shipbuilding in the States since that date. Mr. Denny was expected back in Dumbarton again about the last week in July.

The order for a sailing barque booked by the Ailsa Shipbuilding Co., Troon, is noteworthy in two ways. The vessel will be the largest—3,000 tons deadweight capacity—as yet undertaken by the builders, and the placing of the order now, when steamers cannot be had fast enough, indicates that everyone has not yet quite lost faith in the sailing ship. With the exception, however, of the four-masted schooner ordered about two-and-a-half months ago by Mr. John Ena, of Honolulu, from Messrs Robert Duncan & Co., Port-Glasgow, this is the first order for a sailing vessel that has been placed on the Clyde for a comparatively long period. The last sailing vessel, of any size, turned out by Clyde builders was the *Inverclyde*, launched by Messrs. Russell & Co., Port-Glasgow, early last year.

Messrs. Anderson, Rodger & Co., shipbuilders, Port-Glasgow, have been granted a renewal of their lease of the graving dock owned by the Port-Glasgow Harbour Trust. That body have also resolved to accept the offer of Tangye's, Limited, Birmingham and Glasgow, to provide new engines and pumps for the dock. The dimensions of this dock—which was constructed in 1873-74, and superseded an older one, dating from 1762, the first graving dock, in fact, formed in Scotland—are: length, 310 ft.; entrance width, 45 ft.; depth of water on sill at high water of spring tides, 16 ft.

The vacancy in Lloyd's Register Committee, caused by the death of the late Mr. T. C. Guthrie, Glasgow, has been filled up by the election of Mr. William Law, of Messrs. Thomas Law & Co., shipowners, who now joins the committee as the representative of the Clyde Sailing Ship Owners' Association.

With the formal opening of the new graving dock at Troon by the Marchioness of Ailsa, which event took place—as more fully detailed elsewhere in this issue—on the 29th June, the Ailsa Shipbuilding Co., who will work the dock under arrangement with the Duke of Portland, who owns it, have not only had their facilities for docking and repair work immensely enhanced, but have had an increase made to their yard area, and the addition of another building berth. Through the provision of pumping machinery capable of serving both the new dock and the one formerly existing, the engines up till now serving the latter are dispensed with, and they are being taken advantage of to drive the firm's saw-mill and wood-working machinery. For particulars as to the dimensions and capacity of the new dock, I refer readers to the illustrated account elsewhere given in this issue.

Mr. George Brown, who for the past eight or nine years has been yard manager with Messrs. William Denny & Brothers, Dumbarton, has resigned that position, and intends starting business as a shipbuilder, along with other partners, somewhere on the Clyde, probably in the vicinity of Clydebank or Yoker, in anticipation of the passing of the Clyde Trust Bill providing for large tidal docks there. Mr. Brown, who as a young man was a brilliant student under the auspices of the Science and Art Department, bringing the much-coveted gold medal north of the Tweed, gained his experience in the shipyard of Messrs. Alex. Stephen & Sons, of Linthouse. Going to Messrs. Denny & Brothers, about 18 years ago as a leading draughtsman, he in time rose to be chief, and about eight or nine years ago, as stated, he was promoted to the managership of the outside work of the shipyard, Mr. John Ward, partner in the firm, and formerly yard manager, however, retaining much of the responsibility.

The Campbeltown Shipbuilding Company, whose stocks are kept constantly occupied, have received during the month an order for another screw-steamer for the Bristol Steam Navigation Co. of Bristol, a sister vessel to the s.s. *Silvio*, which the company built for them some time ago, and intended to replace the s.s. *Cato*, also built by the Campbeltown Co., but which was lost off the coast of Cornwall during the heavy storm in March last. The new vessel, like her sister ship *Silvio*, is to be of the part awning-deck type, 230 ft. long between perpendiculars, 32 ft. 8 in. beam, 17 ft. 6 in. depth moulded, and to have a deadweight capability on Board of Trade freeboard of close on 2,000 tons. Engines capable of driving the vessel 10 knots when loaded will be supplied by a Glasgow firm, the Campbeltown Co. not being themselves engineers. They have also on the stocks at present a steamer 290 ft. long and 3,400 tons deadweight.

For the erection of a new general engineering works, Messrs. Speedie & Motion, Glasgow, have feued four acres of ground at North Motherwell, and operations will at once be begun. Negotiations are also in progress for the transference of a foundry from a neighbouring town to North Motherwell. A large and commodious new boiler shop has been added to the works of Messrs. J. Dalgleish & Son, engineers, of Pollokshaws.

Messrs. Stevens & Struthers, brass and bronze founders, well known for their specialities in the way of sirens for use on board ship and in lighthouses, as well as for their production of the heavy and intricate bronze castings—stems, stern posts, propeller brackets, &c.—for Government cruisers, gunboats, &c., have now removed from their old premises at Cranstonhill, and occupy splendid new works at the foot of Kelvinhaugh Street, Glasgow. The shops and yard area are much more extensive than in the old works, and they are lit throughout by electricity. Electricity is also used to drive most of the machinery, overhead cranes, &c.

The watertight windows and doors to which reference was made in these notes in the June issue, as being fitted to a steamer then on the stocks in a Clyde yard, are the invention of Mr. James Hamilton, one of the partners in Messrs. Robert Napier & Sons, Govan; and the vessel in which they are fitted is the Royal Mail Steam Packet Co.'s steamer *Tagus*, which, as already mentioned, was launched from the yard of the firm named in the last week of June. Apart from the material of which they are made—this being a special white metal, the invention of Mr. Lawson of the New Howe Machine Co., Bridgeton, Glasgow, having properties which insure for it extended adoption in shipbuilding—the windows and doors are distinguished from others in having applied to them the principle of air compression for watertightness. The application consists of a pneumatic tube of rubber, which is let into a recess running round the fixed frame of the window or door, and which when the opening frame is closed, presses against the tube in the fixed frame, the closing action inflating the tube thoroughly and thus rendering the contact of the two frames thoroughly watertight. The *Tagus* has as many as 240 of such windows fitted along her deck-houses, all of larger dimensions than usual, and the weight of these, in the aggregate, is less by about 14,160 lbs. than if they had been made of cast iron.

Riveting the shell plating of ships by mechanical, in place of manual power, has long been striven after by shipbuilders, and the inventors they have called to their aid. but up till the present no very satisfactory solution of the problem has been arrived at, although numerous appliances have been tried, and modifications have been made in structural methods in order if possible to meet the machine-tool maker half way. It has become pretty well known that developments in this special and highly important direction have been going on in America, especially in the Chicago Shipbuilding Co.'s. premises, as was gathered from the elaborate paper on pneumatic riveting, read at the recent Civil Engineering Congress by Mr. Babcock, the manager of the Chicago Company's yard. The tools there referred to are those made by the Chicago Tool-Making Company, but improved in many details by the Shipbuilding Company. An installation of similar tools, along with all needful plant in the way of air-compressing engine, piping, &c., has recently arrived in the Clyde, and is being applied to actual work in various yards by Messrs. John Macdonald & Son, of York Street, Glasgow, representing the Agents-in-general, Messrs. Taite, Howard & Co., London. Demonstrations have already been given in the shipyard of Messrs. Alexander Stephen & Sons, Linthouse, when the action of the tools—which are operated by American workmen specially sent over with them—was favourably commented upon by representatives from a large number of the most important yards on the Clyde, at Belfast, and from Sunderland.

Whilst the admiration for the drilling, chipping, and caulking tools and for the deck and tank top riveter was unstinted—these tools having already highly approved themselves in yards, boiler-shops and locomotive shops all over the kingdom—it was the shell-riveter that was the centre of greatest interest. The work done by it, however, on the shell of a large ship, it was felt left something to be desired. The effective closing of the heavy and curved plating seemed scarcely to be attained by the machine shown, and, whilst this can be remedied no doubt by increasing the pressure applied and the calibre of the machine to do the work, this means increase of weight, and it is largely due to the lightness and great adaptability of the pneumatic over the hydraulic system of tools that the former are being regarded with such favour by shipbuilders determined to have mechanical substituted for manual labour in shell-plating. As to the descriptive details, and views of the tools at work, I hope to communicate these in a separate article later. The tools are about to be taken to the yard of Messrs. Russell & Co., Port-Glasgow, and thence, after a week or two's thorough trial, to that of Messrs. Denny & Brothers, Dumbarton, when even a more important public demonstration of the capabilities of all the tools, and especially the shell riveter, will be given.

The question of Clyde New Docks, and rival promoters. with which the air around St. Stephen's has been thick for many weeks, and with which the columns of Clydeside journals have been full and overflowing for the same period, may be disposed of here very shortly, until at least what is actually to come out of it all is better known. So far as the fate of the Renfrew Dock Bill is concerned, history has repeated itself at Westminster. The measure has for a second time in succession found favour with a Select Committee of the House of Commons, and as it was passed over two months ago by the Upper House, its success may now be looked upon as assured. The Bill for docks promoted by the Clyde Trust has by no means been so fortunate. According to the proposals it contained, two new docks were to be constructed, one at Shieldhall, on the south side of the river, and the other at Clydebank, farther down on the north side. The House of Lords Committee allowed both to "go forward," but the Commons Committee have ruthlessly divided the scheme, and, whilst granting powers for the making of the Clydebank Dock, have refused those in connection with Shieldhall. On the merits of this decision conflicting views are certain to prevail on the Clyde; but, however high feeling may run, it will be generally allowed that the committee have discharged the duties entrusted to them in an able and impartial manner. The mere facts that the proceedings lasted over three weeks, and that 15 working days were occupied with the examining of evidence and the delivery of speeches, are enough to show that the inquiry has been of the most thorough and exhaustive kind. From all this it seems to follow that greater importance than usual ought to be attached to the decision of such a Committee. For the Renfrew Corporation and Mr. Spiers, of Elderslie, who has so stoutly and persistently backed it in the matter, it means that their hopes and expectations are about to be realised. Whilst it has been resolved that their scheme can be carried out in its entirety, the Clyde Trust have virtually been told that two docks embraced in their scheme was one too many, and so having given Renfrew sanction to build one on the south side of the river, the committee have struck out Shieldhall and restricted the trust to extra accommodation on the north side. It should not now be long before events declare which side has been most genuine and most justified in seeking powers for new dock accommodation on the river.

Although trade in the shipbuilding yards of Dundee has been fairly good for a considerable time past, there have been very few new orders booked; in fact since the beginning of the year only two orders of any consequence have been booked. The latest of these is a twin-screw passenger steamer which Messrs. Gourlay Brothers & Co. have contracted to build for a New Zealand firm. The vessel is to be specially designed and handsomely fitted for the passenger trade, and will be 190 ft. long, 30 ft. broad, and 13 ft. 6 in. deep, with a tonnage of between 700 and 800 tons gross measurement. On the 12th ult. the firm launched an ice-breaking and passenger steamer to the order of the Canadian Government, which was named *Minto*, in honour of the Earl of Minto, the Governor of Canada.

Mr. George C. Buchanan, engineer to the Dundee Harbour Trust, has had his salary increased from £450 to £600 per annum. There was some chance of Mr. Buchanan being placed on the short leet of candidates for the post of chief engineer to the Aire and Calder Navigation Trust, the salary attached to which is £1,000, but in view of the increase granted to him by the Dundee Harbour Board, Mr. Buchanan telegraphed withdrawing his letter of application.

THE TYNE.

(From our own Correspondent.)

Shipbuilding — The visit of the Naval Architects to the North this year has been in every way a success, and it would, we think, be somewhat difficult to say which will recall with most pleasurable feelings the proceedings of the week—the visitors or the visited. It is certain that the arrangements made for ensuring the comfort and convenience of the former, and giving them generally a pleasant time during their stay were very complete indeed; and the heartiness and goodwill displayed by the local gentlemen who had the advantage of being present at the various functions in the week's programme, were no less conspicuous. The visitors, wherever they went, proved themselves appreciative guests, and there cannot be the least doubt that this meeting of associates of an institution connected with the greatest industry of the age will have resulted in many new friendships being formed between leading men in shipbuilding and engineering, and many old ones being cemented This, of course, is only by the way. A result of much greater consequence, which may be looked for, is the stimulating effect of having productions, and the manner of production, brought directly under the observation of the most capable experts. Such contact as this is beneficial to all concerned, and acts as a spur to scientific progress; and it cannot be denied that the annual gatherings of the members of the Naval Institute are doing a great deal of valuable work in this special direction.

Simultaneously with the visit of the Naval Architects two important announcements have been made, which, when carried out in their entirety, will give to the district of the Tyne more prominence than ever amongst shipowners and commercial men generally. The first of these refers to Jarrow Slake, in which spacious water-covered area two pontoons are to be placed, either of which will be capable of taking on the largest vessel afloat. Workshops, shearlegs, cranes, and all the other necessary appliances for carrying on a large engine and ship repairing business will be provided, and the contract for making a new quay and other improvements of a kindred kind has, we understand, already been placed. This enterprise is being undertaken by the Smith's Dock Co., of North Shields, who some months ago acquired as much of the area as they deemed requisite for the purposes intended, as mentioned in the MARINE ENGINEER at the time. A new forge of considerable extent and up-to-date equipment is approaching completion in the vicinity, and it is probable that in a very few years from now this once comparatively dull and deserted locality will become the scene of as much activity as can be witnessed at any other centre on the Tyne.

The second announcement refers to the great developments that are about to take place in connection with the firm of Messrs. Robert Stephenson & Co., shipbuilders and engineers, of Newcastle and Hebburn. A new company is being formed, of which Sir Joseph Pease is to be chairman and Sir Christopher Furness one of the directors. The names of several other gentlemen of eminence in the industrial world have been mentioned in connection with the enterprise, which is sure to add largely to the commercial importance of the Tyne. Among other projects contemplated by the new directorate is the formation of a large graving dock in contiguity to the Hebburn yard, and this undertaking, it is expected, will be started at once. It will be capable of accommodating vessels of the very largest class, and will be provided with every modern accessory which is requisite to ensure effective and economical working. The existing works, including the shipyard and engine works, are, it is understood, to be extended and developed, and there is every reason to expect that the whole establishment will be placed upon a footing of equality with the leading industrial concerns in the kingdom. We understand that an order for a large passenger vessel of the twin-screw type, has been placed with Messrs. Hawthorn, Leslie & Co. by the syndicate who represent the Russian Volunteer

Fleet, and that she is to be fitted with water-tube boilers, which, as well as the engines, are to be constructed at the firm's St. Peter's Works. This eminent Tyneside firm have built many very superior vessels for the same owners, the last being, we believe, the s.s. *Kherson*, which, as she lay in the river during the fitting out period, was the object of universal and exceptional interest. It is no exaggeration to say that the *Kherson* was amongst the very finest vessels that ever left the Tyne, and it is satisfactory to find that the Russian gentlemen who cater for the requirements of the celebrated fleet referred to, are so well satisfied with what they got from the firm on former occasions that they come back to them when another vessel is needed. The firm have some meat ships still in hand, and have commenced the construction of the torpedo-boat destroyers ordered by the Admiralty. In the graving dock a vessel of large size is receiving an extensive overhaul.

At Messrs. Swan & Hunter's yards business continues exceedingly brisk, and it is thought probable that a further accession of work will shortly come to the firm in the shape of a contract for the two great pontoons about to be constructed for the Smith's Dock Co. Nothing is as yet definitely known as to the placing of this contract, but it is very generally admitted that Messrs. Swan & Hunter have unique facilities for dealing with this kind of work, having already beaten all records as far as regards rapidity of construction; and it is therefore considered probable that their selection for the execution of this important work, is assured.

Messrs. Armstrong, Whitworth & Co. are still engaged in extending the building capacity at their Low Walker Yard, and are also carrying out other improvements, which it is expected will prove very valuable when completed. The company have contracted for the building of two or three more ice-breaking vessels, one of which, it is said, will be of even greater size and power than the now celebrated *Ermack*. The latter vessel, in the short time it has been afloat, has achieved marvellous feats in releasing vessels from imprisonment in ice-bound seas, and in view of the wonderful capabilities exhibited by this remarkable vessel, it is certain that the frozen regions of the north will in future be more accessible to navigators than they have been.

Messrs. Wigham, Richardson & Co., Limited, are reported to have received from a well-known Hamburg firm of shipowners an order for a cargo boat of very large carrying capacity and generally superior equipment. The engines and boilers will also be supplied by the firm, who, it is expected, will be able to give delivery by the end of 1900.

The Northumberland Shipbuilding Co., who have a large amount of work in progress on the stocks, have, it is understood, arranged with a newly formed company for the building of a large cargo boat, the engines for which will also be constructed on the Tyne. The firm have recently launched a fine vessel, ordered by Newcastle owners, and they have another well advanced towards completion.

Notwithstanding the scarcity of new business in shipbuilding, which subject has been the almost universal theme of conversation in commercial circles for some weeks past, it is understood that the Palmer Co. have booked some orders lately, though particulars are not forthcoming. Many people believe that it is the high price of tonnage which is the principal hindrance just now to the placing of new orders; but we venture to think that, if the need for additional tonnage were very urgent, no considerations as to cost would prevent the giving out of orders. The truth is that at present the shipping trade is not in too flourishing a condition, and until an improvement takes place, it is useless to expect any special liveliness in the ordering of new tonnage.

The Tyne Shipbuilding Co. continue to have plenty of work in progress, and at Messrs. Readhead's yard the usual state of activity is noticeable. Messrs. Wood & Skinner's and Messrs. Dobson's yards are fairly busy, and at Eltringham's and other establishments, where only vessels of a small class are built, the building berths are fully occupied.

The graving docks at various centres on the Tyne are just now being fully utilised, the vessels in hand for repairs or painting being considerably in excess of the average at this time of year.

Engineering.—At the St. Peter's Engine Works business has been very brisk for a long time, and now a further accession of work has come, which will help to keep things briskly going over the winter months. We refer to the twin engines for the newly ordered Volunteer boat, which will, it is understood, be put in hand as soon as practicable. The Neptune Works at Walker are well supplied with orders, and at the Wallsend Slipway Works business continues exceedingly brisk.

The Palmer Co.'s engineering department is showing well sustained activity, and the same may be said respecting the engine and boiler shops at Messrs. Readhead's. Both the marine and locomotive departments of Messrs. Stephenson's South Street Works are kept actively going, and at Messrs. Hawthorn, Leslie & Co.'s Forth Banks Works a similar condition of briskness is to be witnessed.

Messrs. Dinning & Cook, of the Percy Ironworks, Newcastle, have acquired a site at Walker Gate, on which they contemplate erecting a large iron foundry and a pattern-making shop, both of which will be fitted with modern machinery and appliances of the most approved descriptions with a view to the production of high-class castings. There is just now a large demand for superior castings from electrical and general engineering firms and from shipbuilders, and to cater for this ever-widening market, with some degree of success, is the expectation of the well-known firm which now proposes to supplement its Newcastle works by additional works at Walker Gate. Since Messrs. H. Watson & Sons, the well-known manufacturers of ships' pumps, feed-water filters, &c., removed part of their business to this centre some years ago, the growth of the place has been very rapid, and in many well informed quarters, it is considered probable that it will eventually become one of the main business centres of the district.

The engineering firms engaged in the manufacture of steamship accessories, are in nearly all instances very busy, and forging establishments have still as much work as they can deal with. In the iron foundries orders are plentiful, and the same may be said in reference to brass foundries and copper smithing works.

The engineering departments at the Elswick Works (Messrs. Armstrong, Whitworth & Co.), are very actively employed, and the operatives who were recently laid idle through the occurrence of a fire in the ordnance shops, are now nearly all re-engaged in other departments of the works. The restoration of the burnt-down shops is being rapidly proceeded with, as also are the extensions in other parts of the works.

Blyth.—The Blyth Shipbuilding Co. are at present very busy, all the berths being occupied with vessels in various stages of progress, while alongside the yard the s.s. *Somerford*, ordered by Messrs. Speeding, Marshall & Co., Sunderland, is receiving her equipment. Both the company's graving docks are occupied with vessels undergoing extensive repairs, and the graving docks of the Blyth Dry Dock Company are similarly engaged. At the coal shipping staithes business has been fairly active for some time past, and is likely to show further improvement.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—Through the visit of the naval architects to Sunderland one fact of importance has been elicited, namely that the north pier will be completed next year. The construction of the south pier (half of which has already been put down) will, it is certain, be delayed as little as possible, and it is quite within the bounds of probability that this new harbour of refuge on the north-east coast will be ready for use in three years from now. The other works of extension and development which the Wear Commissioners have in hand will be progressing meanwhile, and it is not too much to say that by the time the piers are completed the importance of Sunderland as a port will have become greatly enhanced. The improvement of the port will strengthen the hands of local shipbuilders, who, even with the disadvantage of a comparatively small water area for launching and mooring purposes, have kept pretty well up in the race of competition, and who may be trusted not to lag behind under the better conditions promised.

Messrs. J. L. Thompson & Sons, are now adding another large shed to their frame adjusting, and building department, and have ordered suitable machinery to equip it. This addition to the premises will doubtless (as it is intended to do) greatly facilitate the carrying out of contracts, and will ensure to the firm an additional means of outdistancing their competitors the matter of output. The firm are reported to have received an order for three large steamers from Messrs. Hogan, of Bristol, a firm for whom they have built many vessels, and to whom they must have given thorough satisfaction, if the placing of repeat orders may be taken as an indication. They have a large amount of other work in hand, and will have full need for all the additional facilities they are bringing into existence. The firms' Manor Quay repairing works are exceedingly busy, there being three important contracts in hand, while others it is stated are being arranged for. The yards of Messrs Blumer, and the Strand Shipbuilding Company are fairly busy the first-named firm having four vessels on the stocks, while at the last named establishment there is a good deal of repair work in hand in addition to the new work.

Sir James Laing & Sons have the building berths at their yards pretty fully occupied, several of the vessels in hand being of large size and of superior class. It is reported that the firm are negotiating for some new orders, but no definite particulars have as yet become known. The firm have just completed very extensive repairs to the oil carrying steamer *Le Coq*, which has been taken to the South Dock for "bunkering" &c., preparatory to going to sea.

Messrs. Robert Thompson & Sons have four vessels on the stocks and one in the water fitting out; while at Messrs. Doxford's and Messrs. Pickersgill's yards, there are five and three vessels respectively in process of building. Messrs. Priestman & Co. have an exceptionally large vessel in the plating stage, and one or two others in earlier stages; but the yard does not, on the whole, appear to be particularly busy.

Messrs. Short, Brothers, launched, early in the month, a fine vessel, 375 ft. long, ordered by the Southern S.S. Co., and have just delivered an equally fine steamer, if a little less in size, built to the order of Mr. James Knott, of the Prince line, Newcastle. Both these vessels are splendid specimens of the modern high-class cargo boat, and are not only a credit to the firm who turned them out, but also to the port in which they were produced. The firm have several other vessels of a special and superior class in progress, most of which, it is expected, will be placed in the water by the end of the year. It may be stated that the officials of the Boilermakers' Society have, for reasons best known to themselves, continued to annoy the firm with their attentions up to the middle of the month (July), the most objectionable of their tactics being the placing of pickets near the yard, to persuade men from seeking work there, and to entice (if possible) the men out who were at work. The Boilermakers' officials have, of course, no kind of excuse for doing this, as they have nothing whatever to do with the yard, and never had; but the utter want of success on the part of their pickets, either to entice men out or persuade men to keep away, has apparently had its effect, and the picketing has, we understand, now been discontinued. Meanwhile, the firm have an abundance of labour at their disposal, and are likely to have an exceptionally large output this year.

There is a good deal of repair work in the port just now, and all the graving docks are occupied with vessels, undergoing more or less extensive overhauls.

Engineering.—At the Palmer's Hill Works, business is very active, there being several repair and re-boilering contracts in hand in addition to the new work. The department in which Dickinson's patent crank shaft is manufactured is particularly brisk, and the demand for this speciality is well sustained. The extensions, which have been long talked of, are, it is reported, shortly to be undertaken, and will, it is supposed, be very comprehensive in character. At the Scotia Engine Works (Messrs. William Allan & Co.) a large vessel, has just been fitted with her machinery, and there are other vessels being fitted with their engines and boilers at Messrs. Doxford's and Messrs. Clarks'. The Sunderland Forge and Engineering Works still continue very busy, and it would be difficult to say which has most work —the electrical or the forging department. The Monkwearmouth Iron Works are kept well employed, and both iron and brass foundries have still a sufficiency of orders to keep them fully going. Manufacturers of patent anchors are kept very busy, principally on local orders.

The Hartlepools.—Shipbuilding shows no signs of falling off, both new and old work being still abundant. Engine works are also kept fully employed, and local steel works continue working full time.

Stockton.—At this centre shipbuilding continues brisk, the work in hand being sufficient to keep all berths occupied. The extensions at Messrs. Craig, Taylor & Co.'s Yard, which are well advanced towards completion, are of a most important character and will add very materially to the productive capacity of the yard.

Middlesbro'.—It is understood that Sir Raylton Dixon & Co., have booked an important order from a Hamburg firm, and as the firm have already several large contracts on their books, it is apparent that the existing briskness of the yard is sure to continue for some time to come. Engineering and boilermaking works still keep busy, while at the steel works the pressure of business is undiminished.

THE MERSEY.

(*From our own Correspondent.*)

ALTHOUGH here and there some falling-off as regards new work coming forward is reported in the shipbuilding and marine and general engineering trades of this district, the position generally is one of sustained activity. Machine-tool makers especially are exceedingly well engaged, and a good deal of overtime is being worked, whilst boiler makers, locomotive builders, and structural engineers continue fully employed. Evidence of the present brisk condition of trade is afforded by the numerous works extensions that are being pushed forward in various directions. In the Manchester district, besides the large new shops that are being erected by Sir W. Armstrong, Whitworth & Co., Limited, Messrs. Crossley Bros. are extending their establishment, and Messrs. B. & S. Massey are doubling the capacity of one of their erecting shops, and tool makers, textile machinists, and boiler makers in other Lancashire centres are carrying out similar enlargements. With the exceptional activity in trade, wages questions necessarily crop up in various centres. In Mid-Lancashire the employers have refused to concede an advance of 2s. asked for by the men and the men have threatened to strike. At Liverpool an advance of 6d. per week in local rates has been conceded, which makes an advance of 2s. since the strike.

The monthly returns issued by the trade union societies are again of a very satisfactory character. The Amalgamated Society of Engineers reports a slight increase in the number on out-of-work donation, which is now 2½ per cent. of the total membership, but this is largely due to the unfortunate fire at Sir W. Armstrong, Whitworth & Co.'s works at Elswick, which has thrown a considerable number of men out of employment, and it does not, of course, represent any falling-off in trade. Locally the number on benefit shows a further decrease, the proportion being less than 2½ per cent., and the district officials report considerable difficulty in supplying the demand for smiths, pattern makers' and fitters. In the Steam Engine Makers' Society there is only one per cent. of the total membership on benefit, whilst in the Lancashire centres practically a clean book is reported. The United Machine Workers' Association has now less than two per cent. of the total roll on benefit, and only 1⅓ per cent. in this district. At Salford, Hartlepool, Barrow, Stockton, Keighley, Bradford, Doncaster, Huddersfield, Blackburn, Ashton-under-Lyne, Crewe, Preston, Gloucester, Wigan, Woolwich, Erith, Hammersmith, Westwood, Loughborough, Grimsby, Attercliffe, and Liverpool, this organisation has no members receiving out-of work donation. Returns as to state of trade continue very favourable.

The British Westinghouse Electric and Manufacturing Co., Limited, which has been formed for the purpose of establishing works for the production of all descriptions of electrical machinery and plant, not only on a larger scale than any now existing in this country, but probably more extensive even than those at Pittsburg, have entered into arrangements with the Trafford Park Estates Co. for the purchase of 40 acres of land on the banks of the Manchester Ship Canal, and here, it is stated, works are to be erected, which will give employment to some 5,000 hands. This important industrial development may mean that Manchester will in the future become the centre for the manufacture of electrical appliances, whilst it will necessarily give an important impetus to the progress of the Ship Canal. Numerous other works are either in progress or in contemplation on the Trafford Park Estate, and amongst other firms Messrs. Morell & Mills, shipwrights; Messrs. W. H. Bailey & Co., engineers; W. T. Glover & Co., electrical engineers; the Lancashire Dynamo and Motor Co., and the Trafford Power and

Light Supply Co. have secured sites for works, which in some cases are already in course of erection.

The Ardwick Engineering Co., of Manchester, have a new design in quadruple-expansion engines for marine and other requirements where space is limited. This engine, which is made in sizes of from three to 25 H.P., has balanced cranks, and the feed, circulating, and air pumps are worked direct from the crossheads. It is of very compact design, and is made as light as possible consistent with strength. The company also make a special form of oil engine, the novel feature of which is that it can be converted, if desired, into a gas engine. When it is required to effect this change, all that is necessary is to disconnect the oil tank and vaporiser. The crank, which runs in oil, the connecting-rod, &c., are boxed in the column, an arrangement possessing obvious advantages in the way of compactness and cleanliness. The engine is strongly proportioned throughout, and all the working parts are of steel, so that the risk of breakdown is reduced to a minimum.

A new patent flux for strengthening cast-iron, steel, &c., is being manufactured by Messrs. James Evans & Co., of Salford, Manchester. By means of this composition, all descriptions of castings, "from piano frames to projectiles," can be strengthened from 10 to 25 per cent., according to the mixture and nature of the iron used. The flux is placed in the ladles which take the iron as it comes from the cupola, and is then stirred with a dry loamed rod, or if required, special apparatus can be supplied for feeding the flux with the blast. The action of the flux is immediately noticeable in the clear and exceptionally fluid state of the treated iron, and it is claimed that blow holes and other points of weakness are prevented, whilst no obnoxious fumes are emitted during its action. For strengthening a ton of iron about 20 to 25 lbs. of the composition are used. We have ourselves seen iron castings which, after treatment by this process, showed an increased strength of over 20 per cent., as compared with castings prepared in the same way, but with no admixture of the flux.

The London Fire Appliance Co., of Manchester, are supplying a very handy double-lid bucket, specially suitable for fire extinguishing requirements where a good deal of dust is continually floating in the atmosphere. The lid opens automatically on either side when the user is throwing the water, but when not in use, and with the handle in an upright position, the lid remains tightly closed, so that no dust can get in to thicken or suck up the water, whilst natural evaporation is largely prevented.

A continued strong advance in prices, with an increasing scarcity of supplies, has been the general report throughout the iron trade during the past month. Makers and manufacturers, in fact, have little or nothing to offer for anything like prompt delivery, their difficulty being to keep up supplies on account of contracts already in hand. In pig-iron there has been a general rise of 6s. to 10s. per ton, and on business put through, chiefly for deferred delivery, full prices have been got. Local makers are practically out of the market, and refusing to quote at all. Lincolnshire makers have put up their prices about 10s. per ton, and even at these rates are unable to promise early delivery; delivered Manchester 75s. 6d. for foundry net, and delivered Warrington 73s. 2d. for forge, are their quotations. Derbyshire foundry has risen to about 76s. 6d. net delivered here, with scarcely anything offering Middlesbrough is about 10s. dearer, and exceedingly difficult to obtain; for good foundry brands, by rail Manchester, 84s. net is the minimum rates. Scotch iron has advanced about 6s., 78s. to 78s. 6d. net being quoted for delivery Manchester Docks. There is little or no American pig-iron offering for present delivery, but there are quotations for supplies to come over with the October cotton shipments at 74s. net Manchester Docks, which represents a substantial rise on recent rates.

Finished-iron makers are exceedingly busy. In bars the home trade is exceptionally brisk, with producers considerably behindhand with deliveries, whilst the shipping business is unprecedented for this time of the year. Both Lancashire and North Staffordshire bars have been officially advanced another 10s. per ton, local makes being now quoted £8 5s. to £8 10s., and North Staffordshire £8 10s. as the minimum, delivered here. Sheets have risen about 15s., the price being now £9 10s. Hoops are in steady home request, with a heavier shipping demand than has been experienced for many years past; list rates have been put up 10s. per ton, random being £8 12s. 6d. and special cut engths £8 17s. 6d. delivered Manchester district and 2s. 6d. less for shipment. In wire rods something like a "famine" of supplies exists. Foreign competitors have practically withdrawn from the market, and English makers are quite full of orders, with prices stiff at £8 15s. to £9.

Nut and bolt makers have put up list rates 10s. to 20s., and iron and steel boiler tube makers have reduced discounts 2½ per cent, representing an average advance in prices of about 5 per cent.

Prices in the steel trade have also shown a strong upward move. Hematites are about 7s. higher, 87s. 6d. less 2½ being now the minimum for No. 3 foundry, with billets 5s. up, £6 2s. 6d. net cash being quoted, delivered here. Bars range from £7 15s. to £8 and upwards, and boiler plates are now £9. Steel hoops have been advanced 10s., £9 being the new rate, with makers full up right through the autumn, whllst sheets have risen to £10, delivered in this district.

The metal market continues active with prices hardening, but no change in list rates. Delivered Manchester district solid-drawn brass boiler tubes remain at 9d.; condenser tubes, 10½d.; copper tubes, 11½d.; brazed copper gas and steam tubes, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d.; common brass wire, 8½d.; copper wire, 10¼d. per lb.

Timber has been in fair demand; although imports have been large, deliveries have fairly kept pace, and stocks have not increased unduly, whilst prices are without much change. Teak squares have been imported moderately; the demand is fair, and prices show some improvement, with stocks not heavy. Planks are in good request at steady rates. There are no arrivals of greenheart to report, but consumption has been light and stocks are heavy.

The coal trade shows no material change, all descriptions, except the better qualities for house-fire purposes, being in brisk request, with prices firm. In house coals some stock is going down, notwithstanding shorter time—about four days—is being worked at many of the pits, but this will be fully required for winter needs, and local collieries are holding to their list rates, although cheaper lots are on sale from outside districts. Steam and forge coals move away freely, with prices strong on the recent basis. Engine fuel is in active demand, and supplies are becoming increasingly scarce, collieries having a difficulty in keeping up deliveries, with the result that prices are hardening, slight advances being quoted on forward contracts. At the pit's mouth best Wigan Arley averages 11s. 6d. to 12s. 6d.; Pemberton four ft. and seconds Arley 10s. to 11s.; and common house coal 9s. to 9s. 6d.; steam and forge coal 8s. 9d. to 9s.; with engine fuel 6s. 6d. to 6s. 9d. for best; 5s. 6d. to 5s. 9d. for medium, and 4s. 9d. to 5s. for common slack.

Shipping is brisk in some quarters, but prices are without quotable change, ordinary steam coals averaging 9s. 6d. to 9s. 9d.; Garston Docks, 10s. to 10s. 3d. High level, Liverpool; and 10s. 3d. delivered Partington tips, Manchester Ship Canal.

THAMES.

(From our own Correspondent.)

Babcock & Wilcox.—Some trouble came over one of the tubes of a Babcock & Wilcox boiler in one of the merchant steamers, and in making his report of the tube the Board of Trade Inspector showed how it had got hurt. We do not remember that it was explained that this same tube had been plugged up, and, in that condition, and with no water in it, had been left to the mercy of the fire. It naturally got red hot and naturally bent into rather a fantastic shape. But this was not as a circulating medium of the boiler. A very important contribution to the matter has been made by Mr. Charles Wilson in a letter. He there gives an account of the behaviour of the Scotch boilers in the *Hero*, and also the behaviour of the water-tube boilers in their place. During the first six voyages of the vessel the average mean speed was 11·45 knots on a consumption of 178 tons of coal; and the average mean speed of the last six voyages with the Scotch boilers was 11·3 knots on a consumption of 163 tons. After that water-tube boilers were fitted in, when the mean speed on the same voyage was 12·75 knots on a consumption of 165 tons. When the lower tubes were examined at the end of the voyage they were found to be quite straight. These tubes were 1⅝ in. diameter and 7 ft. 6 in. long. The last voyage of the s.s. *Hero*, of the Wilson Line, showed a consumption of 17 cwt. per hour with an I.H.P. of 1364 and speed

12·78 knots. This is 1·39 lbs. of coal per I H.P. per hour. The boilers in the *Hero* are four years old, and she has never once been detained during that time for boiler repairs. Several tubes in the lower row have been renewed, but none of the upper ones have been taken out. The business of the firm in marine boilers is fairly brisk. Already ten war ships of the United States have been fitted with these boilers. The latest of these being the monitor *Wyoming*, the dimensions of the engines of which are

$$\frac{17\text{ in.} \times 26\tfrac{1}{4}\text{ in.} \times 40\text{ in.}}{24\text{ in.}}$$

It is a twin-screw-ship and four boilers have been fitted into her. The cruiser *Cincinatti* is the other later ship. She is of 5,000 I H.P., and she has eight Babcock & Wilcox boilers fitted into her. In the merchant service the latest notable orders are from the Steel Wire Co., which is having five of its steamers fitted with them. Each steamer is of 2,000 I.H.P. In this country Cook has four of his excursion steamers fitted with water-tube boilers for the trips on the Nile. The latest of these pleasure Nile steamers is the *Serapis*, built by Messrs. Alley & MacLellan, Glasgow. There is one boiler and the engines are 125 I.H.P. The names of the other three steamers are *Oonas* (one boiler, engines 125 I.H.P.), *Rameses* (two boilers, engines 375 I.H.P.), and *Mahomet* (one boiler, engines 125 I.H.P.). There has also been fitted lately into a ship for the Volga named the *Bernsa*, one boiler, fitted with apparatus for burning liquid fuel. Her engines are of 650 I.H.P. H.M.S. *Sheldrake* has just come home from another 1,000 miles trial, and no hitch has yet been reported. The consumption of coal is said to have been 1·56 lbs. per I.H.P. per hour.

Sturtevant Fan Co.—Fans made on the centrifugal force principle, can send air along pipes at considerable pressure. The highest pressure that can comfortably be reached with the Blackman fan is ¾ in. of water. The Sturtevant can go up to 25 in. of water. Such a fan is best suitable for fire blasts and cupola furnaces. These fans are made of different sizes and are known by numbers. No. 0, at 1½ in. of water, delivers 200 cubic feet per minute, and uses ·125 I H.P. to drive it. No. 4, when giving air at 1½ in. of water, delivers 400 cubic feet, and uses ·2 H.P. They are simply driven by counter shafting from the main shafting or by a steam engine and belts to the pulleys of the fan, or by an electric motor and counter shafting.

Messrs. Caird & Rayner.—The exhaust steam of the auxiliary engines in steamships for feed pumps, circulating pumps, generating electricity, compressing air, or forcing water is to be utilised by an invention of this firm for producing fresh water. Usually the steam used for evaporation is taken direct from the boilers or from a donkey boiler. Usually also, the exhaust from the auxiliaries for the above purposes is allowed to escape at considerable pressure. This firm provides a receptacle into which the exhaust of all the auxiliary engines is led, and from which the steam then passes to the evaporator. The receptacle is provided with a safety valve, and steam escaping by it is led to the main condenser. "The fresh-water condensing apparatus may be used for several purposes. The water resulting from the condensation of the exhaust steam being used as feed-water for the boilers, whilst that resulting from the condensation of the vapour generated by condensation of the exhaust steam may be used for drinking and culinary purposes or for feed make-up.

Messrs. Yarrow & Co.—This firm had the trial of a Japanese torpedo-boat destroyer, *Akebona*, one of six similar vessels ordered by the Japanese Government, and we are now in a position to give particulars. The type of engine is the four-cylinder triple expansion. The high-pressure cylinder is 20½ in.; intermediate pressure, 31½ in.; and the two low-pressure, 34 in. in diameter; the stroke being 18 in. They are twin-screw, and the engine balanced on the Yarrow, Schlick and Tweedy principle. There are four boilers. The engine can indicate 6,000 I.H.P., and the boilers can supply steam for 1,600 I.H.P. each. On April 24th she made a mean speed on trial of 31·159 knots. The boats are each 220 ft. long and 20 ft. 6 in. beam. They have four funnels and a conning tower, and the armament consists of one 12-pounder and five 6-pounder quick-firing guns, and two swivel tubes for 18 in. torpedoes. The expansion joint for steam pipes consists of dividing the pipe for a short length into two branches, arranged in the form of a square. The pipe by that is allowed to expand and contract, and it is taken up by a partial rotation in the pipe; the junctions are similar to those of a trunnion joint. There are two movements which these joints have to provide for, the expansion or contraction due to change of temperature, and the constant movement of the vessel, in rough water, the latter often being the more important of the two.

An important discussion took place in the House of Commons, on the motion of Mr. William Allan, on the Belleville boiler. A correspondent of the *Daily Chronicle* says that as the B Fleet at the naval manœuvres sailed past they could tell which were fitted with Bellville boilers by the quantity of smoke issuing from the funnels. Almost the first signal was, "Too much smoke." Mr. Goschen said the extra consumption was due to auxiliary machinery, electric lighting, &c. One point against the water-tube boiler is that they cannot use salt water, and within the first two days two cruisers were put out of action. It is said the Niclausse boiler will be introduced as a rival to the Belleville.

BELFAST.

(From our own Correspondent.)

VERY little falls to be reported this month in connection with the shipbuilding and engineering trades in Belfast, owing to the summer holidays occurring during the month, which cause a general slackening-down previous to the holidays themselves, and naturally the resumption of work is anything but prompt, so that the best part of the month is lost. Then, again, owing to the dearth of riveters, &c., the shipyard work has been seriously delayed.

Up to date we have had no launches. Messrs. Workman, Clark & Co , Limited, despatched the well-known Allan liner *Parisian* on July 13th. It will be remembered that early in the year this vessel was taken off her station in order to be thoroughly overhauled and to have new boilers fitted, whilst her engines have been converted into triple-expansion. The original engines in the vessel were, we understand, three crank compound, working at a pressure of 80 lbs. per square inch. Two of the cylinders, we believe, were removed, and suitable new ones fitted at a working pressure of 180 lbs., the steam being supplied from four large steel boilers. After adjustment of compasses and a successful trial in Belfast Lough, during which a speed of 15 knots was obtained, the steamer left direct for Liverpool, in order to load up and resume her former sailings.

On July 7th the s s. *Medic*, built by Messrs. Harland & Wolff, Limited, for the White Star Line, left her moorings in Abercorn Basin, and proceeded down the lough for adjustment of compasses and trial trip. The dimensions of the *Medic* are:—Length, 550 ft.; breadth of beam, 63 ft.; depth, 44 ft. She is of about 12,000 tons gross register, is propelled by twin screws, and her machinery has also been constructed in the builders' own works. The *Medic* is one of the fine new steamers intended for Messrs. Ismay, Imrie & Co.'s new service *via* the Cape from Liverpool to Australia, and her departure on August 3rd will be an important event in shipping circles. Practically in the past the port of communication from the United Kingdom for Australia has been London, so that in inaugurating this new steamship service from Liverpool, Messrs. Ismay, Imrie & Co. will be entering on an entirely fresh field of enterprise. The *Medic* and the other steamers for this service will be provided with accommodation for third-class passengers only, and as there will be no other class on board, the whole of the upper and best parts of the ship will be at their disposal; so that, except for the fact of the fare being simpler and the surroundings plainer, the passengers might be deemed to be travelling first-class. With electric light fitted throughout, immense cargo capacity, facilities for cooling and refrigeration, and all provisions necessary for the comfort of passengers on a long voyage—such as dining-room with separate revolving seats, reading-room, smoking-room, cabins for two or three as well as larger ones—the advent of the *Medic* and her sister ships on this trade promises to add to the popularity and fame of the White Star Line, and will bring our most distant colonies within the reach of those who are obliged to be mindful of economy in travelling. After a very satisfactory trip on the lough, the *Medic* left for Liverpool, with Captain Thornton in command.

Messrs. Harland & Wolff, Limited, have also just built and engined for Messrs. Frederick Leyland & Co., of Liverpool, the new twin-screw-steamer *Winifredian*, which ran a most successful trial trip on July 8th, and immediately after left for Liverpool. The *Winifredian* is intended for Messrs. Leyland's Atlantic service, and is of about 10,500 tons gross register, her length being 552 ft. by 59 ft. beam by 41 ft. deep. Excellent accommodation has been provided for a large number of passengers, whilst the deadweight capacity of the ship is very great. The arrangements for carrying cattle and horses, for the conveyance of which this line is now so well known in the Atlantic, are the very latest, and provision has been made for a large number. Refrigerating plant has also been fitted, as well as electric light throughout, and all appliances for loading and discharging cargo expeditiously and with economy.

Another notable event of the month has been the presentation of the freedom of the City of Belfast to Mr. Ismay, of the White Star Line. The idea originated with the Corporation some months ago, and on becoming known was received with great favour by all classes of the citizens, so much so that the individual subscription towards a casket for enclosing the certificate had to be limited, so as to allow a thoroughly representative list of citizens and artisans being made up. The presentation took place on July 20th in the council chamber, and was followed by a luncheon given by the Lord Mayor (Mr. Otto Jaffe), which was heartily enjoyed by all present. In this connection we may mention that it is officially announced that the s.s. *Oceanic* will be thrown open for public inspection on the 19th of August, and it is expected she will take her departure from this port about the 24th of this month.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—There is still a very brisk trade in shipbuilding in this district, but builders have not lately increased their order sheets, because their hands are so full of contracts which there is pressing need to push along with. Apart from the *Vengeance*, first-class battleship, launched on the 25th of June, Messrs. Vickers, Sons & Maxim have on hand three first-class armoured cruisers and a torpedo-boat destroyer for the Admiralty, and a Japanese battleship of 15,000 tons. This is not as big a programme of work as Messrs. Vickers will ultimately be able to undertake, but at present their hands are full, for considerable attention was necessary to be devoted to the extensions which are going on in the yard every day, to the new machinery which is being put down in every department, and to the development of electricity and its substitution as motive power for steam. Considerable progress has been made during the month with the work in hand. Two launches have taken place —the *Vengeance* and the Pacific Steam Navigation Co.'s twin-screw-steamer *Ortona*, of 7,600 tons, the second largest merchant ship built at Barrow, the largest one being, of course, the *City of Rome*. The cruisers *Hogue* and *Euryalus* are gradually getting into frame, the *Hogue* being the farthest advanced, whilst the keel of the *King Alfred* has already been built up on the ways just vacated by the *Ortona*. At the present rate of progress it is expected that in under 12 months from now the *Hogue* and the *Euryalus* will be launched, whilst the Japanese battleship will doubtless soon follow them. The *King Alfred* is, of course, a very important cruiser, both as regards her size, her armour, and the speed she has to acquire. Naturally the Barrow company will aim to make her as big a success as the *Powerful*, and the latter has been a great success despite the rumours about her being as bad a job as the *Terrible*. It is said the latter is to go out to China to relieve the *Powerful*, and that the *Powerful* will, on coming home, have economisers added to her boilers. If this is done very great economy in coal consumption will be ensured.

Considerable interest has naturally been taken at Barrow in the operations of locally built cruisers in the Naval Manœuvres. The high terms in which the first-class cruiser *Niobe* has been extolled are only equalled by the encomiums passed on the second-class cruiser *Juno*, both built at Barrow, and both spoken of by experts as really good jobs.

Some interesting observations were made on the occasion of the launch of the Pacific Steam Navigation Co.'s steamer *Ortona*, launched at Barrow on July 10th. Mr. Shirley, in the course of his remarks, said he believed the Pacific Co. went as far back as 1841, and it had gone on improving ever since. They had at present 37 ships, and of these four were in the Australian trade, 20 were in the West Coast trade, and 13 were in the trade between Liverpool and West American ports. When first the company commenced its trade with South America they employed paddle-steamers. Little by little the trade grew, but it was felt to be impossible to employ steamers between Liverpool and Valparaiso until the late Mr. John Elder made a practical success of his arrangement for the compound engine. Then, and not till then, were they able to run steamers direct from Liverpool to the West Coast of South America. They had gone on improving since then, and when he looked back, he was perfectly surprised at the progress they had made during the last 40 years. He thought he might safely say that 40 years ago they were quite happy in steaming a ship of 1,000 tons deadweight at 10-knot speed at the consumption of one ton of coal per hour, or 24 tons per day. Now they could propel a ship of 5,000 or 6,000 tons on the same consumption of fuel. That meant a very great advance. The *Ortona* was not by any means the first vessel built for the company in Barrow. The Barrow Shipbuilding Co., in 1886, built for the company two steamships, the *Orizaba* and *Oroya*. These steamers were built for the Australian trade, and proved very successful, indeed extremely successful. That induced the company to give out orders to Barrow in 1899 for two other steamers, the *Oruba* and *Orotava*. The first two of these four vessels were still running, and he thought with the exception of the ordinary expenses in connection with machinery, there was nothing the matter with the ships or engines. He hoped the Pacific Co. would continue to prosper long after he and the present directors had gone, and that there would be no realisation of Macaulay's New Zealander sketching on the ruins of London Bridge the ruins of St. Paul's, but that on the contrary he would come to this country with a return ticket by the Pacific Line. Mr. Adamson, the director of Vickers, Sons and Maxim, who has the management of the Naval Construction Works, told the guests at the launch that as far as he was personally concerned, his first connection with the Pacific Co. did not carry him back to 1841, but he could go back a very long way. The first job he got when he went to Messrs. John Elder's works was to trace a drawing of the *Talca* in 1862, a paddle ship built for the Pacific Co., and he designed the first ship for the company to cross from Liverpool to Valparaiso, the *Magellan*. Since that time he had to do with 20 or 30 vessels built for that company. When he left the Clyde he lost connection with the company, but picked them up again when he came to Barrow. He hoped now they had got in touch again they would keep building for the company when they wanted ships. With the exception of the *City of Rome*, the *Ortona* was the largest merchant vessel ever launched from the Barrow yard. Lloyd's Committee visited Barrow on the occasion of the launch of the *Ortona* and were entertained by Messrs. Vickers, Sons & Maxim. Mr. James Dunn, a director of Vickers, Sons & Maxim, and late of the Admiralty, said he felt that he could speak for a very long time on the merits of this committee, but as he happened to be a member of the technical branch of that committee, he was precluded from uttering eulogiums, to which they were so fully entitled, but he ventured to say on behalf of the firm of Vicker's, that at no place would they receive a more cordial welcome than at Barrow. They were especially pleased to see them, and he had especial pleasure in seeing amongst them several who worked with him on the load-line enquiry including the chairman, vice chairman, and Mr. Martell, the chief surveyor of Lloyd's. Mr. Glover, the chairman of Lloyd's Committee, remarked that the committee invented a sort of ideal, and they did their best to enforce it. They had on this outing travelled to Cardiff, Newport, Swansea, Liverpool, Belfast, and Barrow, and from the commencement of their journey to its close they had seen nothing but enterprise, energy, progress, intelligence, and determination to excel in every direction, and what more could they expect from a community engaged in that particular branch of industry than those qualities. They were the qualities of manhood, and of enterprise, of which they had so good an example in their chairman that day. The ship *Ortona* would give example of the industry, energy, and enterprise of the 19th century, and would help to show such progress as would form a magnificent foundation for the further progress expected from England in the century that was to come.

We have frequently written about the great scarcity of house accommodation at Barrow, and a month or two ago reported the fact that Messrs. Vickers, Sons & Maxim had decided to build a thousand workmen's houses on Walney Island within a mile of their works. They have actually commenced with the work, which will be pushed on with all speed, but there is an immediate pressing demand for houses, and with a view to bridging over the temporary difficulty, Messrs. Vickers have purchased the old Guion Line steamer *Alaska*, the famous "greyhound of the Atlantic," which will be moored in the Devonshire Dock at Barrow, and utilised as a home for 400 to 500 workmen employed at the shipyard. A gangway will be thrown from the ship to the shore, and the men will live aboard as in a club, being provided for by stewards who will cook their food and otherwise attend to their comfort. The idea, novel most certainly, has caught on with the men and is likely to be popular. The cost of living on board will be small, because no profits will be charged, and as long as the necessary expenses are found the firm will not trouble. The management of the ship will be be placed in the hands of a committee elected by and of the men. This is perhaps the first instance on record in which a large shipbuilding company has found it necessary to house a large number of its workmen in a temporary floating house until permanent accommodation is provided. It is understood the ship will have fulfilled her purpose as a home for workmen in 12 months from now, when the new houses on Walney Island are expected to be ready for occupancy; but when these thousand houses are ready, another difficulty will arise as to the means of crossing Walney Channel. A bridge is absolutely necessary, for a thousand workmen rushing off to their dinner at one time cannot possibly be dealt with in the ordinary ferry boats. That question is now being considered, but from a present view of the question, a bridge is the only means of dealing with the difficulty.

Another large slice of land, several acres in extent, has been acquired by Messrs. Vickers, Sons & Maxim for the extension of the engineering and boilermaking department of their yard. New iron and steel casting shops are needed, together with other departments calculated to make the works a complete whole, and self-resourceful.

The installation of electric motors for the purpose of driving all sorts of machinery is going on apace at the Barrow Yard. The change is found to be most economical, very convenient, and capable of dealing with a fuller programme of work. Not only is electricity being utilised in the engineering department, but in the ship department as well. The way in which electrically driven punching machines are worked even when dealing with the heaviest of plates is marvellous. Further extensions in the use of electric motors may be looked for.

Arrangements are in progress for commencing work at the docks in the deepening of the sill of the Ramsden Dock by six feet. The work has been entrusted to Messrs. John Aird & Co., the well-known contractors, and they are at present engaged in getting their plant and tools ready so that the work can be started when the *Vengeance* is docked and the s.s. *Ortona* is finished and ready for sea. When these ships are placed, one into the docks and the other cleared of the docks, the entrance to Ramsden Dock will be closed for about ten months for the necessary alterations. Accommodation is being provided specially for the 400 men who will be employed on this job on Barrow Ramsay Island. The entrance basin of Ramsden Dock will be used as usual for heavy tonnage shipping and the entrance to the Devonshire Dock will be used for lighter craft.

The torpedo-boat destroyer *Otter*, one of the four 30-knotters built at Barrow, has successfully passed her official trials, and will be forthwith delivered to the Admiralty. The torpedo-boat destroyer now building at Barrow for the Admiralty will also be a 30-knotter. She will be named the *Vixen*.

West Cumberland.—There is a very brisk and steady business in the West Cumberland district, and shipbuilders are likely to be well off for orders for some time to come. The yards at Workington and Maryport are now engaged on a number of light craft ships, which will be followed by others as soon as the slipways are clear.

Shipbuilding Material.—There is a very brisk demand for shipbuilding material, and the steel mills in the district are fully employed, and likely to be so for a considerable time to come, on the contracts already in hand. Prices have advanced on the month, and are now quoted at £7 10s. for ship plates, and £8 12s. 6d. for boiler plates. All other classes of steel are in considerable request, and the outlook is a decidedly good one.

Hematites.—The Hematite pig-iron trade is very busy, and the fact that the demand is so much greater than the supply has run up prices considerably. Mixed Bessemer numbers are quoted at 80s. per ton net f.o.b. and warrant iron is at about the same value. Stocks have been further increased and now stand at more than 240,000 tons in warrant stores. Makers hold practically no stocks at all.

Shipping.—The shipping trade is busy, but the exports compare unfavourably with the returns for last year up to the same period. There are expectations, however, of big shipments during the remainder of the season.

OBITUARY.

Edwin Blackburn.

It is with regret that we have to announce the death of Mr. Edwin Blackburn, of Carlton Mount, Higher Tranmere, Liverpool, who was for about thirty years past the head engine draughtsman to Messrs. Laird Brothers, he was taken ill about three months ago, with bronchitis and throat trouble, but recently he seemed to rally somewhat. On Sunday afternoon, July 16th, he suffered a relapse, and passed peacefully away shortly before five o'clock. He leaves a widow, five daughters, and four sons, three of the latter being abroad. Mr. Blackburn, whose name and work were known throughout the engineering world, served his apprenticeship at Messrs. Fawcett. Preston & Co.'s, Liverpool, and in 1860 came from that firm to the drawing office at Messrs. Laird's, of which he was appointed chief over thirty years ago, serving in that responsible position until the time of his last illness. He was largely instrumental under Mr. R. R. Bevis, engineering manager, in securing for the Birkenhead Ironworks their great reputation as designers of effective engines. In the engineering world Mr. Blackburn's work was widely known, and it was thoroughly respected by all firms entering into competition with Messrs. Laird Brothers. He was thoroughly wrapped up in his profession; and his mind was a perfect storehouse of engineering statistics, and, indeed, he could enumerate practically every "job" he had turned out for the last forty years, with the areas, pressures, piston strokes, and an infinity of detail relating to each of them. On July 18th at Bebington Cemetery, Liverpool, the body was laid to rest, in the presence of a large company of mourners. He was well-known in Tranmere, where he had resided for so long, and out of respect to his memory, blinds were drawn and shutters closed along the route taken by the cortège.

Miscellaneous.

Three in One Oil.—Under the above comprehensive title the South British Trading Co., Limited, of 6, Victoria Avenue, Bishopsgate Street Without, London, E.C., are placing upon the English market an oil, which has been used in America with marked success for many years past. As its title implies, it has three useful functions, viz., it will clean, prevent rust, and lubricate. It appears to be capable of removing sticky and gritty substances from surfaces to be cleaned. It will prevent rust forming on iron and steel work from exposure to sea air, rain, dampness, or mud, therefore it is viscous enough not to run off and will not evaporate, but thoroughly cover and enter the pores of the material. In acting as a lubricant it has sufficient body to prevent its being forced out from between the surfaces to be lubricated. It is particularly applicable for firearms and other iron and steel instruments. As evidence of its utility we have seen copies of testimonials from Colonel Cody (the renowned Buffalo Bill) and Colonel Roosevelt, the governor of New York State, both of whom speak very highly as to its qualities as the result of practical experience.

Nunn, Ridsdale & Co.—The nautical and general lamp, and ship fitters' business of Ridsdale & Co., lately carried on at 54, Minories, has been purchased by the well-known firm of Messrs. W. & A. Nunn, of Shadwell. They have taken into partnership Mr. G. H. Gibson, who was for many years with the late firm, and will in future be known as Nunn, Ridsdale & Co., of 54, Minories, with works at Shadwell—manufacturers of every description of ship's lamps, lanterns, fog horns, ship fittings, Holmes rescue and distress signals, Colomb's flashing signals, and Robertson's patent boat rowlocks, &c.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Mavisbrook.—On June 6th Messrs. William Gray & Co., Limited, launched the handsome steel screw-steamer, *Mavisbrook*, built to the order of Messrs. Miller & Richards, of Glasgow. The vessel will take Lloyd's highest class, and her dimensions are:—Length, overall, 300 ft.; breadth, 42 ft.; and depth 21 ft. 9 in. The deck erections consist of a poop, bridge, and forecastle, with tasteful saloon and cabins for officers, &c., in the poop. The engineer's rooms are in the bridge, and the crew's accommodation forward. The hull is built with deep bulk angle frames, and a cellular double bottom and aft peak tank; five steam winches, steam-steering gear amidships, hand screw-gear aft, horizontal donkey boiler, steam windlass, boats on beams overhead, grain divisions, stockless anchors, two telescoping masts, and a complete outfit provided for a first-class cargo vessel. The Central Marine Engine Works of Messrs. W. Gray & Co., Limited, supply their triple-expansion engines, having cylinders 21½ in., 35 in., and 58 in. diameter, with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The ceremony of naming the steamer *Mavisbrook* was gracefully performed by Mrs. Miller, wife of the managing owner.

Verulam.—On June 24th there was launched by Messrs. S. P. Austin & Son, Limited, at Sunderland, the steel screw-steamer *Verulam*, constructed under special survey at Lloyd's for 100 A1 class, and of the following dimensions:—Length, 268 ft.; breadth, 37 ft. 9 in.; depth, moulded, 19 ft. 9 in. Messrs. John Dickinson & Sons, Limited, are supplying the machinery.

Algores.—On June 24th there was launched at Maryport, for Messrs. R. Penny & Sons, of Shoreham, a steel schooner-rigged steamer of about 375 tons gross, named the *Algores*.

Clan Farquhar.—On June 24th there was successfully launched from the shipbuilding yard of Messrs. Doxford & Sons, Limited, the turret-ship *Clan Farquhar*, the ninth vessel of this type built by the firm for the Clan Line Steamers, Limited, Glasgow (Messrs. Cayzer, Irvine & Co.), and the 51st turret steamer now afloat. Her dimensions are: 440 ft. long by 51 ft. 6 in., and 32 ft. moulded, and she has a deadweight capacity of 8,400 tons. Her engines are: 27½ in., 45½ in., 75 in., and 60 ft. stroke, and have also been built by Messrs. Doxford & Sons. The *Clan Farquhar* was constructed under the British Corporation Survey, highest class.

Grosmont.—On June 26th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw-steamer of the following dimensions, viz.:—Length, between perpendiculars, 325 ft.; breadth extreme, 46 ft.; depth, moulded, 24 ft. 9 in. This steamer, which has very fine lines, and is a very handsome vessel of her type, has been built to the order of Messrs. Gladstone & Co., West Hartlepool, off the three-decked rule, having full poop, long bridge, and top-gallant forecastle. The saloon and cabins for the captain and officers will be fitted up in the poop, and the accommodation for engineers will be provided in iron houses on the bridge deck, the crew being berthed in the forecastle as usual. She has double bottom on the cellular principle for water ballast, and has been designed to carry a deadweight cargo of about 4,850 tons on Lloyd's summer freeboard on a light draught of water. She will have all the most recent appliances for the expeditious loading and unloading of cargoes, has direct steam capstan windlass, steam-steering gear amidships, with powerful screw-gear aft, four large steam winches, multitubular donkey boiler, stockless anchors, &c. This is the fourth steamer built by Messrs. Ropner & Son for the same owners. She will be fitted with a set of triple expansion engines by Messrs. Blair & Co., Limited, working at a pressure of 210 lbs. The christening ceremony was gracefully performed by Miss Isabel Rudd, of Ivy Croft, Stockton-on-Tees, who gave her the name of *Grosmont*.

Vinolia.—On June 27th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler—of the following dimensions: 112 ft. by 21 ft. by 11 ft. 6 in., depth of hold—built to the order of the Arctic Steam Fishing Co., Limited, Grimsby. Messrs. C. D. Holmes & Co., of Hull, are supplying triple-expansion engines, and the vessel will be complete with all modern appliances for trawling. Miss Bates, of Grimsby, named the vessel the *Vinolia*, and after the ceremony the company adjourned to the offices of the builders for luncheon.

Atlantian.—On June 27th Sir W. G. Armstrong, Whitworth & Co. launched from their Walker Shipyard a large steamer of the following dimensions, viz.:—Length, 500 ft.; breadth, 57 ft.; depth, moulded, 43 ft. 9 in., with a deadweight carrying capacity of about 11,500 tons. She has been constructed of steel, in accordance with Lloyd's rules for their 100 A1 class, the Board of Trade passenger regulations, and the American law. The vessel is of the twin-screw type, and has been built to the order of the West India and Pacific Steamship Co., Limited, of Liverpool. The vessel will be fitted with twin-screw triple-expansion machinery by the Wallsend Slipway and Engineering Co., Limited. The vessel was named *Atlantian* by Mrs. Stitt, wife of Mr. J. Carlton Stitt, one of the managing directors of the company.

Somerford.—On June 28th there was launched from the Shipbuilding and Repairing Works of the Blyth Shipbuilding Co., Limited, of Blyth, a steel screw-steamer for Messrs. Speeding, Marshall & Co., of Sunderland. The dimensions of this vessel are:—Length, 282 ft.; breadth, 40 ft. 9 in.; and a depth of 20 ft. 6 in. The vessel is built to secure Lloyd's 100 A1 class, and is on the single-deck principle with deep frames. The cabin accommodation is fitted on top of bridge amidships; the officers' and engineers' berths are under the bridge, and the crew in forecastle. Triple-expansion engines of good power will be supplied and fitted by Messrs. MacColl & Pollock, of Sunderland. As the vessel left the ways, the ceremony of naming her *Somerford* was gracefully performed by Miss Marshall, daughter of one of the managing owners. After the launch the company adjourned to the builders' luncheon room, where the usual toasts were proposed and duly acknowledged.

Steam Launch.—On June 29th there was launched from the shipyard of the Lytham Shipbuilding and Engineering Co. a twin-screw steam launch, built of galvanised steel to the order of the Egyptian Delta Light Railways Co., of London, and is specially designed for towage service, &c., on the Nile Delta, by Messrs. Flannery, Tritton & Given, who have also superintended the construction of the vessel and her machinery, the special features being high speed on exceedingly light draught of water. The vessel is intended not only to carry cargo and passengers in connection with the railway system in Upper Egypt, but is also fitted for towing barges of suitable character for the conveyance of produce and native passengers. Experience has shown that the Nile lends itself specially for economical towage in combination with light draught, and very considerable developments of this trade are expected in the near future.

Bath City.—On July 6th there was launched from the North Sands Shipbuilding Yard of Messrs. Joseph L. Thompson & Sons, Limited, Sunderland, a finely modelled steel screw cattle and cargo steamer, named the *Bath City*, which has been specially built to the order of Messrs. Charles Hill & Sons, and is intended for their Bristol City Line to New York. She is of the following dimensions:—Length, between perpendiculars, 310 ft.; breadth, extreme, 40 ft. 6 in.; and depth, moulded, 26 ft. She is built on Lloyd's three-deck rule for the 100 A1 class, with a poop, bridge, and topgallant forecastle. She has two complete decks, water-ballast right fore and aft in the double-bottom and also in the after peak. The accommodation for the captain, officers, saloon passengers' berths, &c., is fitted in the poop aft. The engineers and petty officers are berthed in the fore end of the bridge, and the crew and firemen in the topgallant forecastle. The cattlemen's berths are fitted under the bridge. The deck machinery is of a powerful description, and consists of eight steam winches for the cargo hatches, each hatch being worked by double derricks. A steam windlass is fitted on the forecastle head, and steam-steering gear is fitted in a large wheel-house, and a screw-gear on the poop deck. The deck machinery is supplied with steam from a large donkey boiler. The vessel is rigged as a two-masted fore-and-aft schooner with five sails, and has awnings fitted in way of all accommodation. Four large boats are fitted on the bridge deck. The vessel is divided by the usual watertight bulkheads carried up to the weather deck. Shifting boards are fitted throughout the holds and 'tween decks. The poop and bridge, and bridge and forecastle are connected by strongly constructed gangway bridges. At each side of the vessel large gangway doors are constructed in the bulwarks, in way of the cargo hatches. A large steel chart and wheel-house is fitted on top of the bridge at the fore end, and over this is constructed the usual flying bridge. On top of the poop a large entrance house has been constructed. Patent stockless anchors are fitted, and a large fresh-water condenser. The vessel throughout is fitted as a first-class cattle and cargo steamer, with all the latest improvements for the rapid loading and discharging of cargoes. The machinery has been constructed by Messrs. Blair & Co., Limited, of Stockton-on-Tees, the sizes of the cylinders being 24 in., 40 in., 66 in. by 45 in. stroke, supplied with steam by two large multitubular boilers working at 160 lbs. pressure. The shafting is considerably in excess of Lloyd's requirements, and the engines have been built to a very complete specification. As the vessel left the ways the christening ceremony was gracefully performed by Miss Dora M. Jones, daughter of Captain Richard Jones, who will take command, and who is superintending the completion of the vessel which has been chiefly constructed under the superintendence of Mr. James Bailey, of Bristol. There was a large company present at the launch, which was effected by hydraulic power. The usual adjournment was made to the builders' luncheon room, where suitable toasts were duly honoured.

Lord Ormonde.—On July 8th Messrs. Dobson & Co. launched at Walker-on-Tyne a steel screw-steamer for the Irish Shipowners' Co., Limited, of which Messrs. Thomas Dixon & Sons, Belfast, are the managers. The dimensions of the vessel are:—Length, overall, 372 ft.; breadth, 46 ft. 3 in.; depth, moulded, 29 ft. 10½ in. She is built to Lloyd's highest class as a spar-deck vessel. The propelling machinery has been constructed by Messrs. John Dickinson & Sons, Limited, of Sunderland, and consists of a set of triple-expansion engines, having cylinders 24 in., 40 in., and 64 in., by 48 in. stroke. The vessel was christened *Lord Ormonde* by Miss Rosa Magill.

North Sea—On July 10th Messrs. Craig, Taylor & Co., launched from their shipbuilding yard at Thornaby-on-Tees, a steel screw steamer of the following dimensions, viz., 278 ft. by 40 ft. 8 in., by 20 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's under special survey, and is of the single-deck type, with poop, bridge, and forecastle; water ballast in double bottom fore and aft, and in peak; she is on the deep frame principle, and has large clear holds, and large hatches. She will carry about 3,000 tons deadweight on a light draught of water, and is fitted with patent steam windlass, patent steam-steering gear, four large steam winches, Meredith donkey boiler, screw-gear aft, telescopic mast to Manchester Canal requirements, and all the latest improvements. The propelling machinery has been constructed by Messrs. Thomas Richardson & Sons, Limited, Hartlepool, the cylinders being 21 in., 35 in., 57 in., by 39 in. stroke, two large boilers 160 lbs. pressure. This vessel has been built to the order of Messrs. Sanders, Wake & Co., London, under the superintendence of Mr. W. C. Carter, of 30, Great St. Helens, London. As she left the ways, she was gracefully christened the *North Sea* by Miss Wake, of London.

Petunia.—On July 10th Messrs. Cochrane & Cooper, Limited, launched from their yard at Selby a new steam trawler of the following dimensions, 115 ft. by 21 ft. 6 in. by 11 ft. 6 in., built to the order of the North-Eastern Steam Fishing Co., Grimsby. Engines of triple-expansion type are being supplied by Messrs. C. D. Holmes & Co., of Hull, and the vessel will be completed with all the most modern appliances for trawling. As the vessel left the ways she was christened the s.s. *Petunia* by Miss Alice A. Allen.

South Australia.—On July 10th this large and handsomely modelled steel screw-steamer—built for the Australian trade to the order of the Southern Steam Shipping Co., Limited, of London, of which Messrs. Lawther, Latta & Co. are the managers—was launched from the works of Messrs. Short Bros., Sunderland. This vessel, which is constructed of steel throughout, has been built under special survey to the highest class in Lloyd's register, and is of the following dimensions:—Length, 370 ft.; breadth, 48 ft.; and depth, moulded, 30 ft., with a large deadweight and carrying capacity, and has a continuous permanent shade-deck extending from forecastle to poop. Large and commodious deck-houses are fitted amidships on shade-deck for the accommodation of captain, officers, and engineers, with large and handsomely fitted saloons, the panelling being in polished hardwoods tastefully arranged. On the flying bridge deck a large and commodious teak wheel and chart house is fitted, the steam-steering gear is fitted in the engine-room with controlling rods to wheel house and flying bridge. The crew are berthed in the forecastle, which is divided by a passage-way, and further divided for petty officers, &c. The double-bottom is constructed on the cellular system, subdivided into trimming tanks, the peaks also being fitted for water ballast. The holds are four in number, which for rapid loading and discharging have been fitted with eight powerful steam winches, steam for which is supplied by a large multitubular donkey boiler placed in the stokehold. In addition, the vessel is fitted with all the newest appliances for despatch, and the economical handling of cargoes. A complete installation of electric light is also fitted. On leaving the ways the vessel was named *South Australia*, the ceremony being performed by Miss Dora T. Short, of Sea View, who was handed a very handsome present by one of the directors on behalf of the company. The vessel is to be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of Stockton-on-Tees, having cylinders 26 in., 42 in., and 70 in., with a stroke of 48 in., and two large steel boilers of 180 lbs. working pressure, fitted with Howden's system of forced draught.

Ortona.—On July 10th Messrs. Vickers, Sons and Maxim, Limited, launched at Barrow a large twin-screw steamer for the Australian mail and passenger service of the Pacific Steam Navigation Co. Miss Rankin, daughter of one of the directors of the Pacific Co., named the vessel *Ortona*. The steamer is 500 ft. long, 55 ft. beam. and 37 ft. moulded depth to upper deck, her gross tonnage being 7,600 tons. The hull is constructed of steel on the cellular double-bottom principle, and completed throughout to Board of Trade requirements. The vessel, as is the case with all the other steamers of the company, is not classed, but her scantlings are sconsiderably in excess of Lloyd's requirements. There are three complete closed-in decks, and accommodation is provided for 130 first, 162 second class, and 300 steerage passengers The machinery has been designed to give the vessel an average speed at sea when fully laden of 15½ knots. The propelling machinery consists of two sets of inverted, vertical, direct-acting, triple-expansion engines, each set having three cylinders working on separate cranks. The cylinders are:—High pressure, 30 in. diameter; intermediate pressure, 50 in. diameter: low pressure, 83 in. diameter; and the stroke 54in. The steam distribution valves are of the piston type for high pressure and intermediate pressure cylinders, and the flat double-ported description for low pressure cylinders. They are actuated by valve gear of the ordinary, double eccentric, link motion type, the reversing gear is of the "all round" type, with steam and hand-starting gear. The condensers are cast with back columns of main engines, and are supplied with circulating water from two centrifugal pumping engines. The auxiliaries in the engine-rooms consist of one large duplex ballast pump, one fire engine, two direct-acting main feed pumps, and one auxiliary feed pump, two evaporators, and one auxiliary condenser for taking exhaust steam from all auxiliary engines throughout the ship. The engines are supplied with steam from four double-ended boilers of the marine multitubular type, each fitted with eight furnaces, and worked under Howden's system of forced draught. The boilers are constructed for a working pressure of 190 lbs. per square in., to Board of Trade requirements. A large auxiliary boiler of the cylindrical type is also fitted for supplying steam to all auxiliary engines. The ashes are discharged overboard by means of silent hydraulic ejectors, one being fitted in each stokehole. The machinery throughout has been under the supervision of Mr. James Thomson, superintendent engineer of the Pacific Co., the resident inspector for hull and machinery being Mr. Hugh Brown.

Rollo.—On July 11th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions, 100 ft. by 21 ft. by 11 ft. depth of hold, built to the order of Mr. G. F. Sleight, Grimsby. Engines of triple-expansion type are being supplied by Messrs. C. D. Holmes & Co., of Hull, and the vessel will be completed with all the most modern appliances for trawling. Miss Gladys Sleight named the vessel the s.s. *Rollo*.

Ferndene.—On July 11th the Northumberland Shipbuilding Co., Limited, launched, at Howdon-on-Tyne, a large steel steamer built to the order of Messrs. J. T. Lunn & Co., Newcastle, for the Dene Line. The vessel will take the highest class under Lloyd's survey, and is 352 ft. long by 48 ft. beam, by 28½ ft. depth moulded. The steamer will carry a deadweight cargo of 6,300 tons. Messrs. Thomas Richardson & Sons, Limited, of Hartlepool, will supply the machinery, which consists of a set of triple-expansion engines, having cylinders of 24 in., 40 in., and 66 in. diameter, with a stroke of 45 in., supplied with steam by two large single-ended boilers, working at a pressure of 180 lbs. The steamer was named *Ferndene* by Miss Edith Lunn, daughter of the managing director of the Dene Line.

British Princess.—On July 11th the Palmer's Shipbuilding and Iron Co., Limited, launched from their Jarrow yard a finely modelled steel twin-screw-steamer of the following dimensions:—Length (between perpendiculars), 470 ft; breadth extreme, 56 ft. 6 in.; depth moulded, 35 ft., constructed for the British Shipowners' Co., Liverpool. The vessel will be rigged as a four-masted fore-and-aft schooner, and has been built under special survey to take the highest class in Lloyd's registry. She is of the three-decked type, with two steel decks laid all fore and aft, and has a closed-in shelter deck specially strengthened for the Atlantic trade, extending over the whole length, and above this a shade deck covering the machinery openings. All the available space under the shelter and shade decks is left clear for carrying horses. The vessel is designed to carry upwards of 10,000 tons deadweight on about 27 ft. mean draught. The engines, which are also being constructed by the Palmer Co. are of the triple-expansion twin screw type, with cylinders 26 in., 43 in. and 71 in. diameter by 48 in. stroke, steam being supplied by two double-ended boilers and two single-ended boilers with a working pressure of 190 lbs. On leaving the ways she was named *British Princess* by Mrs. Beazley, wife of Mr. Edwin Beazley, one of the managers of the British Shipowners' Co.

Drumbain.—On Tuesday, July 11th, Messrs. W. Gray & Co., Limited, launched a fine large steel screw-steamer, which they have built to the order of Messrs. W. Christie & Co., of London. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 336 ft.; breadth, 48 ft. 6 in.; and depth, 24 ft. The deck erections consist of poop, long bridge, and forecastle. The saloon and captain's and officers' rooms will be fitted in the poop. The hull is built with deep frames and cellular double bottom and aft peak tank for water ballast, five steam winches, steam-steering gear amidships, hand screw-gear aft, patent direct steam windlass, patent donkey boiler, grain divisions, stockless anchors; and a complete outfit will be fitted for a first-class cargo boat. Three cylinder triple-expansion engines of first-class make are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and large steel boilers to work at a pressure of 160 lbs. per square inch. The ceremony of christening the steamer *Drumbain* was gracefully performed by Miss Florrie Mudd, of Hartlepool.

Hydra.—On July 19th Messrs. Wood, Skinner & Co., Limited, successfully launched from their shipbuilding yard, at Bill Quay, Newcastle-on-Tyne, a handsome new steel screw-steamer, which has been built to the order of Messrs. Bruusgaard, Kiosterud & Co., of Drammen, Norway. The vessel is a sister ship of the s.s. *Hugin*, recently built by that company for the same owners. She is of the improved single-deck type, with bridge and topgallant forecastle, and her principal dimensions are as follow, viz.: Length, 248 ft.; breadth, 35 ft.; depth, moulded, 20 ft. 6 in The vessel will be fitted with a set of engines of the improved triple-expansion type, having cylinders 18½ in., 30 in., and 49 in. diameter respectively, with a stroke of 33 in., supplied with steam from a large steel multitubular boiler working at 160 lbs. pressure per square inch. The engines and boiler have been constructed and will be fitted by the North Eastern Marine Engineering Co., Limited, at the Northumberland Engine Works, Wallsend-on-Tyne. Both the vessel and engines have been built to the highest class, viz., 1 A1* Norwegian Veritas, and have been surveyed during construction by Mr. Lauritz M. Bodin, of Sunderland, the local representative, and also superintended by Mr. Norman Burnett, of Newcastle-on-Tyne, on behalf of the owners. She will be rigged as a fore-and-aft schooner, and fitted with telescopic topmasts, as also with all the latest improvements and appliances in the way of deck machinery, for facilitating the rapid loading and discharging of cargo and general working and navigating. As the vessel left the ways she was christened *Hydra* by Mrs. Gabrielle, wife of Captain Gabrielle, of Christiania, Norway, who will command the steamer when completed and ready for sea. The *Hydra* is the fifth vessel constructed by the builders for Messrs. Bruusgaard, Kiosterud & Co.

Newton Hall.—On July 20th this finely modelled steel screw-steamer was launched by Messrs. Joseph L. Thompson & Sons, Limited, of the North Sands Shipbuilding Yard, Sunderland. She has been built to the order of Messrs. C. G. Dunn & Co., of Liverpool. The principal dimensions of the vessel are:—Length over-all, 379 ft. 6 in.; breadth, extreme, 49 ft. 6 in.; and depth, moulded, 29 ft. 6½ in. The vessel is built on the spar-deck rules to Lloyd's 100 A1 class, under their special survey, and is a fine example of the modern cargo vessel, with all the latest improvements and requirements for the owners' special trade. Water ballast is carried in a cellular double bottom, right fore and aft, and also in the after peak. The accommodation for the saloon, captain, officers, and also spare berths for the accommodation of a limited number of passengers, is placed at the fore end of the bridge, and for the engineers in sidehouses at the after end of the bridge. The crew, firemen, apprentices, and petty officers are berthed in the topgallant forecastle. The vessel is rigged as a two-masted fore-and-aft schooner, with telescopic topmasts to suit the Manchester Ship Canal. A large house is placed at the fore end of the bridge, used as an entrance hall to the saloon, steering room, and chart room. The steam-steering gear is placed at the after end of the engine casings, connected by controlling gear to the bridge steering room, and a powerful screw-gear is fitted aft. There, are four large cargo hatches, with seven powerful steam winches and a patent windlass is fitted forward for the working of the stockless anchors. The steamer is replete with every requirement for the comfortable accommodation of the crew, and for the rapid handling of cargoes. The engines and boilers have been built by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the sizes of the cylinders being 26 in., 44 in., 72 in., by 48 in. stroke, supplied with steam by three large boilers working at 180 lbs. pressure. The launch, which was most successful, was effected by means of hydraulic power, by Miss Dunn, of Alnwick, and was gracefully christened by Miss Handress. There was a large company present at the launch, including Miss Handress; Miss Dunn, of Alnwick; Mrs. Robert Thompson; Madame Lechère, of Antwerp; Mrs James Marr; Mr. Dunn, the managing owner; Mr. Robert Thompson, J.P., the managing director of the builders' firm; Mr. Joseph L. Thompson, J P., of Winston-on-Tees; Mr. James Marr; Messrs. Smidtz and Forceville, of the Societe John Cockerill, of Antwerp; and Mr. Thomas Bredsdorff, of the Flensburger Schiffsbau-Gesellschaft, Flensburg. After the launch the usual adjournment was made to the builders' luncheon room, where the usual toasts were duly honoured. The firm has received an order from Mr. Bredsdorff, for Mr. P. Phorson's patent hydraulic launching gear. The hull and machinery have been constructed under the superintendence of Messrs. Irwin, Atkinson & Young, of Liverpool, and under the personal supervision of Captain Kilvert. This is the second vessel built by this firm for these owners.

Riverton.—On July 24th Messrs. Ropner & Son launched from their shipbuilding yard a very fine steel screw-steamer, 325 ft. long. Her machinery will be supplied by Messrs. Blair & Co., Limited. She has been built to the order of a Newcastle firm, and, as she left the ways, received the name of *Riverton* from Miss Elizabeth Easson, daughter of the inspecting superintendent.

Sparta.—On July 24th Messrs. Richardson, Duck & Co. launched from their yard a steel screw-steamer of the following dimensions:—Length, over all, 309 ft.; breadth, extreme, 42 ft.; depth, moulded, 27 ft. 11 in.; gross tonnage, about 2,750 tons. This vessel, which has been built to the order of Messrs. A. C. de Freitas & Co., of Hamburg, will class 100 A1 at Lloyd's, and has been built under special survey. She is of the spar-deck type, with a large deck-house forward of engine casing, in which accommodation is provided for 18 first-class passengers, with smoke room, ladies' saloon, captain's room, &c., in house above. Engineers and officers are berthed in houses alongside engine-casing, and crew in topgallant forecastle. A cellular double bottom for water-ballast is fitted throughout, also after peak tank, and equipment includes large horizontal donkey boiler by Messrs. Blair & Co., four steam winches, steam windlass, stockless anchors, steam-steering gear, &c. The engines, by Messrs. Blair & Co., Limited, have cylinders 24 in., 40 in., and 65 in. by 42 in. stroke, steam being supplied by two single-ended boilers with a working pressure of 160 lbs. As the vessel left the ways she was christened *Sparta* by Mrs. H. G. Spence, of Elmwood, Hartburn, near Stockton.

LAUNCHES.—Scotch.

Kittiwake.—On June 27th there was launched from the shipbuilding yard of Messrs. T. B. Seath & Co., Rutherglen, a usual flying bridge. On top of the poop a large entrance house has been constructed. Patent stockless anchors are fitted, and a large fresh-water condenser. The vessel throughout is fitted as a first-class cattle and cargo steamer, with all the latest improvements for the rapid loading and discharging of cargoes. The machinery has been constructed by Messrs. Blair & Co., Limited, of Stockton-on-Tees, the sizes of the cylinders being 24 in., 40 in., 66 in. by 45 in. stroke, supplied with steam by two large multitubular boilers working at 160 lbs. pressure. The shafting is considerably in excess of Lloyd's requirements, and the engines have been built to a very complete specification. As the vessel left the ways the christening ceremony was gracefully performed by Miss Dora M. Jones, daughter of Captain Richard Jones, who will take command, and who is superintending the completion of the vessel which has been chiefly constructed under the superintendence of Mr. James Bailey, of Bristol. There was a large company present at the launch, which was effected by hydraulic power. The usual adjournment was made to the builders' luncheon room, where suitable toasts were duly honoured.

Lord Ormonde.—On July 8th Messrs. Dobson & Co. launched at Walker-on-Tyne a steel screw-steamer for the Irish Shipowners' Co., Limited, of which Messrs. Thomas Dixon & Sons, Belfast, are the managers. The dimensions of the vessel are:—Length, overall, 372 ft.; breadth, 46 ft. 3 in.; depth, moulded, 29 ft. 10½ in. She is built to Lloyd's highest class as a spar-deck vessel. The propelling machinery has been constructed by Messrs. John Dickinson & Sons, Limited, of Sunderland, and consists of a set of triple-expansion engines, having cylinders 24 in., 40 in., and 64 in., by 48 in. stroke. The vessel was christened *Lord Ormonde* by Miss Rosa Magill.

North Sea—On July 10th Messrs. Craig, Taylor & Co., launched from their shipbuilding yard at Thornaby-on-Tees, a steel screw steamer of the following dimensions, viz., 278 ft. by 40 ft. 8 in., by 20 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's under special survey, and is of the single-deck type, with poop, bridge, and forecastle; water ballast in double bottom fore and aft, and in peak; she is on the deep frame principle, and has large clear holds, and large hatches. She will carry about 3,000 tons deadweight on a light draught of water, and is fitted with patent steam windlass, patent steam-steering gear, four large steam winches, Meredith donkey boiler, screw-gear aft, telescopic mast to Manchester Canal requirements, and all the latest improvements. The propelling machinery has been constructed by Messrs. Thomas Richardson & Sons, Limited, Hartlepool, the cylinders being 21 in., 35 in., 57 in., by 39 in. stroke, two large boilers 160 lbs. pressure. This vessel has been built to the order of Messrs. Sanders, Wake & Co., London, under the superintendence of Mr. W. C. Carter, of 30, Great St. Helens, London. As she left the ways, she was gracefully christened the *North Sea* by Miss Wake, of London.

Petunia.—On July 10th Messrs. Cochrane & Cooper, Limited, launched from their yard at Selby a new steam trawler of the following dimensions, 115 ft. by 21 ft. 6 in. by 11 ft. 6 in., built to the order of the North-Eastern Steam Fishing Co., Grimsby. Engines of triple-expansion type are being supplied by Messrs. C. D. Holmes & Co., of Hull, and the vessel will be completed with all the most modern appliances for trawling. As the vessel left the ways she was christened the s.s. *Petunia* by Miss Alice A. Allen.

South Australia.—On July 10th this large and handsomely modelled steel screw-steamer—built for the Australian trade to the order of the Southern Steam Shipping Co., Limited, of London, of which Messrs. Lawther, Latta & Co. are the managers—was launched from the works of Messrs. Short Bros., Sunderland. This vessel, which is constructed of steel throughout, has been built under special survey to the highest class in Lloyd's register, and is of the following dimensions:—Length, 370 ft.; breadth, 48 ft.; and depth, moulded, 30 ft., with a large deadweight and carrying capacity, and has a continuous permanent shade-deck extending from forecastle to poop. Large and commodious deck-houses are fitted amidships on shade-deck for the accommodation of captain, officers, and engineers, with large and handsomely fitted saloons, the panelling being in polished hardwoods tastefully arranged. On the flying bridge deck a large and commodious teak wheel and chart house is fitted, the steam-steering gear is fitted in the engine-room with controlling rods to wheel house and flying bridge. The crew are berthed in the forecastle, which is divided by a passage-way, and further divided for petty officers, &c. The double-bottom is constructed on the cellular system, subdivided into trimming tanks, the peaks also being fitted for water ballast. The holds are four in number, which for rapid loading and discharging have been fitted with eight powerful steam winches, steam for which is supplied by a large multitubular donkey boiler placed in the stokehold. In addition, the vessel is fitted with all the newest appliances for despatch, and the economical handling of cargoes. A complete installation of electric light is also fitted. On leaving the ways the vessel was named *South Australia*, the ceremony being performed by Miss Dora T. Short, of Sea View, who was handed a very handsome present by one of the directors on behalf of the company. The vessel is to be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of Stockton-on-Tees, having cylinders 26 in., 42 in., and 70 in., with a stroke of 48 in., and two large steel boilers of 180 lbs. working pressure, fitted with Howden's system of forced draught.

Ortona.—On July 10th Messrs. Vickers, Sons and Maxim, Limited, launched at Barrow a large twin-screw steamer for the Australian mail and passenger service of the Pacific Steam Navigation Co. Miss Rankin, daughter of one of the directors of the Pacific Co., named the vessel *Ortona*. The steamer is 500 ft. long, 55 ft. beam. and 37 ft. moulded depth to upper deck, her gross tonnage being 7,600 tons. The hull is constructed of steel on the cellular double-bottom principle, and completed throughout to Board of Trade requirements. The vessel, as is the case with all the other steamers of the company, is not classed, but her scantlings are sconsiderably in excess of Lloyd's requirements. There are three complete closed-in decks, and accommodation is provided for 130 first, 162 second class, and 300 steerage passengers The machinery has been designed to give the vessel an average speed at sea when fully laden of 15½ knots. The propelling machinery consists of two sets of inverted, vertical, direct-acting, triple-expansion engines, each set having three cylinders working on separate cranks. The cylinders are:—High pressure, 30 in. diameter; intermediate pressure, 50 in. diameter: low pressure, 83 in. diameter; and the stroke 54in. The steam distribution valves are of the piston type for high pressure and intermediate pressure cylinders, and the flat double-ported description for low pressure cylinders. They are actuated by valve gear of the ordinary, double eccentric, link motion type, the reversing gear is of the "all round" type, with steam and hand-starting gear. The condensers are cast with back columns of main engines, and are supplied with circulating water from two centrifugal pumping engines. The auxiliaries in the engine-rooms consist of one large duplex ballast pump, one fire engine, two direct-acting main feed pumps, and one auxiliary feed pump, two evaporators, and one auxiliary condenser for taking exhaust steam from all auxiliary engines throughout the ship. The engines are supplied with steam from four double-ended boilers of the marine multitubular type, each fitted with eight furnaces, and worked under Howden's system of forced draught. The boilers are constructed for a working pressure of 190 lbs. per square in., to Board of Trade requirements. A large auxiliary boiler of the cylindrical type is also fitted for supplying steam to all auxiliary engines. The ashes are discharged overboard by means of silent hydraulic ejectors, one being fitted in each stokehole. The machinery throughout has been under the supervision of Mr. James Thomson, superintendent engineer of the Pacific Co., the resident inspector for hull and machinery being Mr. Hugh Brown.

Rollo.—On July 11th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions, 100 ft. by 21 ft. by 11 ft. depth of hold, built to the order of Mr. G. F. Sleight, Grimsby. Engines of triple-expansion type are being supplied by Messrs. C. D. Holmes & Co., of Hull, and the vessel will be completed with all the most modern appliances for trawling. Miss Gladys Sleight named the vessel the s.s. *Rollo*.

Ferndene.—On July 11th the Northumberland Shipbuilding Co., Limited, launched, at Howdon-on-Tyne, a large steel steamer built to the order of Messrs. J. T. Lunn & Co., Newcastle, for the Dene Line. The vessel will take the highest class under Lloyd's survey, and is 352 ft. long by 48 ft. beam, by 28½ ft. depth moulded. The steamer will carry a deadweight cargo of 6,300 tons. Messrs. Thomas Richardson & Sons, Limited, of Hartlepool, will supply the machinery, which consists of a set of triple-expansion engines, having cylinders of 24 in., 40 in., and 66 in. diameter, with a stroke of 45 in., supplied with steam by two large single-ended boilers, working at a pressure of 180 lbs. The steamer was named *Ferndene* by Miss Edith Lunn, daughter of the managing director of the Dene Line.

British Princess.—On July 11th the Palmer's Shipbuilding and Iron Co., Limited, launched from their Jarrow yard a finely modelled steel twin-screw-steamer of the following dimensions:—Length (between perpendiculars), 470 ft; breadth extreme, 56 ft. 6 in.; depth moulded, 35 ft., constructed for the British Shipowners' Co., Liverpool. The vessel will be rigged as a four-masted fore-and-aft schooner, and has been built under special survey to take the highest class in Lloyd's registry. She is of the three-decked type, with two steel decks laid all fore and aft, and has a closed-in shelter deck specially strengthened for the Atlantic trade, extending over the whole length, and above this a shade deck covering the machinery openings. All the available space under the shelter and shade decks is left clear for carrying horses. The vessel is designed to carry upwards of 10,000 tons deadweight on about 27 ft. mean draught. The engines, which are also being constructed by the Palmer Co. are of the triple-expansion twin screw type, with cylinders 26 in., 43 in. and 71 in. diameter by 48 in. stroke, steam being supplied by two double-ended boilers and two single-ended boilers with a working pressure of 190 lbs. On leaving the ways she was named *British Princess* by Mrs. Beazley, wife of Mr. Edwin Beazley, one of the managers of the British Shipowners' Co.

Drumbain.—On Tuesday, July 11th, Messrs. W. Gray & Co., Limited, launched a fine large steel screw-steamer, which they have built to the order of Messrs. W. Christie & Co., of London. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 336 ft.; breadth, 48 ft. 6 in.; and depth, 24 ft. The deck erections consist of poop, long bridge, and forecastle. The saloon and captain's and officers' rooms will be fitted in the poop. The hull is built with deep frames and cellular double bottom and aft peak tank for water ballast, five steam winches, steam-steering gear amidships, hand screw-gear aft, patent direct steam windlass, patent donkey boiler, grain divisions, stockless anchors; and a complete outfit will be fitted for a first-class cargo boat. Three cylinder triple-expansion engines of first-class make are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and large steel boilers to work at a pressure of 160 lbs. per square inch. The ceremony of christening the steamer *Drumbain* was gracefully performed by Miss Florrie Mudd, of Hartlepool.

Hydra.—On July 19th Messrs. Wood, Skinner & Co., Limited, successfully launched from their shipbuilding yard, at Bill Quay, Newcastle-on-Tyne, a handsome new steel screw-steamer, which has been built to the order of Messrs. Bruusgaard, Kiosterud & Co., of Drammen, Norway. The vessel is a sister ship of the s.s. *Hugin*, recently built by that company for the same owners. She is of the improved single-deck type, with bridge and topgallant forecastle, and her principal dimensions are as follow, viz.: Length, 248 ft.; breadth, 35 ft.; depth, moulded, 20 ft. 6 in. The vessel will be fitted with a set of engines of the improved triple-expansion type, having cylinders 18½ in., 30 in., and 49 in. diameter respectively, with a stroke of 33 in., supplied with steam from a large steel multitubular boiler working at 160 lbs. pressure per square inch. The engines and boiler have been constructed and will be fitted by the North Eastern Marine Engineering Co., Limited, at the Northumberland Engine Works, Wallsend-on-Tyne. Both the vessel and engines have been built to the highest class, viz., 1 A1* Norwegian Veritas, and have been surveyed during construction by Mr. Lauritz M. Bodin, of Sunderland, the local representative, and also superintended by Mr. Norman Burnett, of Newcastle-on-Tyne, on behalf of the owners. She will be rigged as a fore-and-aft schooner, and fitted with telescopic topmasts, as also with all the latest improvements and appliances in the way of deck machinery, for facilitating the rapid loading and discharging of cargo and general working and navigating. As the vessel left the ways she was christened *Hydra* by Mrs. Gabrielle, wife of Captain Gabrielle, of Christiania, Norway, who will command the steamer when completed and ready for sea. The *Hydra* is the fifth vessel constructed by the builders for Messrs. Bruusgaard, Kiosterud & Co.

Newton Hall.—On July 20th this finely modelled steel screw-steamer was launched by Messrs. Joseph L. Thompson & Sons, Limited, of the North Sands Shipbuilding Yard, Sunderland. She has been built to the order of Messrs. C. G. Dunn & Co., of Liverpool. The principal dimensions of the vessel are:—Length over-all, 379 ft. 6 in.; breadth, extreme, 49 ft. 6 in.; and depth, moulded, 29 ft. 6½ in. The vessel is built on the spar-deck rules to Lloyd's 100 A1 class, under their special survey, and is a fine example of the modern cargo vessel, with all the latest improvements and requirements for the owners' special trade. Water ballast is carried in a cellular double bottom, right fore and aft, and also in the after peak. The accommodation for the saloon, captain, officers, and also spare berths for the accommodation of a limited number of passengers, is placed at the fore end of the bridge, and for the engineers in sidehouses at the after end of the bridge. The crew, firemen, apprentices, and petty officers are berthed in the topgallant forecastle. The vessel is rigged as a two-masted fore-and-aft schooner, with telescopic topmasts to suit the Manchester Ship Canal. A large house is placed at the fore end of the bridge, used as an entrance hall to the saloon, steering room, and chart room. The steam-steering gear is placed at the after end of the engine casings, connected by controlling gear to the bridge steering room, and a powerful screw-gear is fitted aft. There, are four large cargo hatches, with seven powerful steam winches and a patent windlass is fitted forward for the working of the stockless anchors. The steamer is replete with every requirement for the comfortable accommodation of the crew, and for the rapid handling of cargoes. The engines and boilers have been built by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the sizes of the cylinders being 26 in., 44 in., 72 in., by 48 in. stroke, supplied with steam by three large boilers working at 180 lbs. pressure. The launch, which was most successful, was effected by means of hydraulic power, by Miss Dunn, of Alnwick, and was gracefully christened by Miss Handress. There was a large company present at the launch, including Miss Handress; Miss Dunn, of Alnwick; Mrs. Robert Thompson; Madame Lechère, of Antwerp; Mrs James Marr; Mr. Dunn, the managing owner; Mr. Robert Thompson, J.P., the managing director of the builders' firm; Mr. Joseph L. Thompson, J P., of Winston-on-Tees; Mr. James Marr; Messrs. Smidtz and Forceville, of the Societe John Cockerill, of Antwerp; and Mr. Thomas Bredsdorff, of the Flensburger Schiffsbau-Gesellschaft, Flensburg. After the launch the usual adjournment was made to the builders' luncheon room, where the usual toasts were duly honoured. The firm has received an order from Mr. Bredsdorff, for Mr. P. Phorson's patent hydraulic launching gear. The hull and machinery have been constructed under the superintendence of Messrs. Irwin, Atkinson & Young, of Liverpool, and under the personal supervision of Captain Kilvert. This is the second vessel built by this firm for these owners.

Riverton.—On July 24th Messrs. Ropner & Son launched from their shipbuilding yard a very fine steel screw-steamer, 325 ft. long. Her machinery will be supplied by Messrs. Blair & Co., Limited. She has been built to the order of a Newcastle firm, and, as she left the ways, received the name of *Riverton* from Miss Elizabeth Easson, daughter of the inspecting superintendent.

Sparta.—On July 24th Messrs. Richardson, Duck & Co. launched from their yard a steel screw-steamer of the following dimensions:—Length, over all, 309 ft.; breadth, extreme, 42 ft.; depth, moulded, 27 ft. 11 in.; gross tonnage, about 2,750 tons. This vessel, which has been built to the order of Messrs. A. C. de Freitas & Co., of Hamburg, will class 100 A1 at Lloyd's, and has been built under special survey. She is of the spar-deck type, with a large deck-house forward of engine casing, in which accommodation is provided for 18 first-class passengers, with smoke-room, ladies' saloon, captain's room, &c., in house above. Engineers and officers are berthed in houses alongside engine-casing, and crew in topgallant forecastle. A cellular double bottom for water-ballast is fitted throughout, also after peak tank, and equipment includes large horizontal donkey boiler by Messrs. Blair & Co., four steam winches, steam windlass, stockless anchors, steam-steering gear, &c. The engines, by Messrs. Blair & Co., Limited, have cylinders 24 in., 40 in., and 65 in. by 42 in. stroke, steam being supplied by two single-ended boilers with a working pressure of 160 lbs. As the vessel left the ways she was christened *Sparta* by Mrs. H. G. Spence, of Elmwood, Hartburn, near Stockton.

LAUNCHES.—Scotch.

Kittiwake.—On June 27th there was launched from the shipbuilding yard of Messrs. T. B. Seath & Co., Rutherglen, a she made a most satisfactory run of 10½ knots on the measured mile. The vessel was constructed under the supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool.

Winifredian.—Lately the new steamer *Winifredian*, belonging to the Leyland Line, intended to trade between Liverpool and Boston, U.S., and built by Messrs. Harland & Wolff, of Belfast, reached Liverpool after making her trial trip. This steamer is fitted in Harland & Wolff's well-known style for 135 first-class passengers, with all the accommodation on the saloon or upper deck, and with all the appointments for the passengers of a first-class liner. Her dimensions are:—552 ft. length overall, with a beam of 159 ft., and a displacement of no less than 20,030 tons. The engine-power is 5,500 H.P., and her total deadweight capacity is about 13,000 tons. It is estimated she could steam round the world without recoaling, and besides carrying about 1,000 horses and 1,000 troops, would still have sufficient carrying capacity left to carry 3,000 or 4,000 tons of stores.

India.—On July 3rd the fine steel screw-steamer *India*, built by Messrs. Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, for the Austrian Lloyd's Steam Navigation Co., of Trieste (of which we gave full particulars in our Launch columns, June issue, page 134), proceeded out to sea for her official trials, under the command of Captain Martinolich. The hull and machinery have been built under the supervision of Mr. Vico Vecchi, naval architect to the owners. Mr. Konhauser, director of the Austrian Lloyd Steam Navigation Co., Mr. Nardin, superintendent engineer, &c., &c., were present at the trial trip, which passed off most successfully.

Auchenarden.—On July 3rd the new steel screw cargo s.s. *Auchenarden*, built by Messrs. Russell & Co., Port Glasgow, and engined by Messrs. Rankin & Blackmore, Greenock (of which we gave particulars in our Launch columns, July issue, page 174), went down the Firth of Clyde on her trial trip with a representative company on board. After running the measured mile the vessel steamed out beyond Cumbrae Head, and returned at full speed to the Tail of the Bank. The engines worked satisfactorily in every way, and a mean speed of 11½ knots was attained on the trial. This fine steamer is fitted with all the latest improvements for the rapid discharge and loading of cargoes, and much satisfaction was expressed with the steadiness of the vessel and the smoothness with which the engines ran.

Cassandra.—On July 4th the new steam yacht *Cassandra*, 228 tons, designed and built by Messrs. Day, Summers & Co., of Northam Iron Works, Southampton, for Mr. F. M. Huth, of Eaglehurst, went out for a trial trip run, and the results obtained were exceedingly satisfactory, the guaranteed speed being considerably exceeded. The dimensions of the yacht are:—Length, 130 ft.; beam, 19 ft.; depth, 12 ft. 6 in. The engines are of the triple-expansion type, the cylinders being 11 in., 17½ in., and 28 in. diameter, and the stroke 21 in. The boiler is 10 ft. diameter and 9 ft. long, working pressure 160 lbs. The speed obtained at the measured mile in Stokes Bay was 11¾ knots, everything working most smoothly with an entire absence of vibration. A series of progressive runs were also made at the mile, by which it was ascertained that a sea-going speed of 10½ knots could be maintained with very economical results.

Brier.—On July 5th the s.s. *Brier*—Laird Liner—which has received new boilers and undergone a thorough overhaul, so as to fit her for the general Irish trade, had a cruise in the Firth of Clyde. A special train conveyed to Gourock the partners—Messrs. G. S. MacLellan, Lewis MacLellan, Wm. MacConnell, J. F. MacLellan, R. G. Turnbull, and J. Imrie—their personal friends, representatives of railway and steamboat companies, and the company's employees, whose annual trip was conjoined with the opening cruise of the vessel. Delightful weather prevailed, and the outing was most enjoyable. The steamer, which was under the command of Captain M'Larty, ran down to Pirnmill, turned, and then hugged the Arran shore round to Brodrick Bay. As a result of the new boilers the speed of the vessel had been increased by a half knot per hour. The *Brier* will take up the Glasgow and Londonderry trade after the Fair holidays, with occasional relief work on the Sligo and Dublin route.

Sirdar.—On July 7th the steel screw-steamer *Sirdar*, built by the Grangemouth Dockyard Co., to the order of Messrs. Orders & Handford, of Newport, for the Orders & Handford Steamship Co. (Limited), (of which we gave particulars in our Launch columns, July issue, page 174), went down the Firth of Forth on her official trip. Both the owner, Mr. Handford, and Mr. Boddy, consulting and superintending engineer, of Newport, who superintended the construction of the vessel and machinery, expressed themselves as entirely satisfied.

Waverley.—On July 8th the latest addition to the Clyde fleet of the North British Steam Packet Co.—the *Waverley*, launched on May 29th, from the yard of Messrs. A. & J. Inglis, Pointhouse—completed her official trials. The vessel is of much larger dimensions than any of the other boats of the company's fleet. She will take the place of the *Redgauntlet* on the daily excursion from Craigendoran round the island of Bute, besides taking part in the general service of the system. The vessel is licensed to carry about 1,500 passengers, a fact which indicates that she ranks among the largest of the pleasure steamers on the Clyde. Not only so, but she has been designed and engined to secure great swiftness, and the results of the trials more than met the stipulated requirements, the vessel having made on the measured mile a speed equal to 19·73 knots an hour. This is said to surpass the speed of any similar boat on the river.

Inchkeith.—On July 8th was witnessed the official trial of the above-named steamer, which is noteworthy as being that of the second steamer in which has been fitted a set of Mudd's patent five-crank quadruple-expansion machinery by the Central Marine Engine Works of Messsrs. W. Gray & Co., Limited, for Messrs. Hamilton, Fraser & Co., of Liverpool. This new departure in marine engine building was taken by the late Mr. Mudd, the first set, as will be remembered, being fitted in the s.s. *Inchmona*. The object in the design of these engines and boilers is the attainment of further economy in coal consumption; and the results obtained in the *Inchmona* have fully justified the anticipations of the builders. But advances of so important a nature could not be made without the confidence and co-operation of those whom they are mainly intended to benefit, and in Messrs. Hamilton, Fraser & Co. the builders found a firm far-seeing and enterprising enough to cordially co-operate with them in their endeavours. As a result of this enterprise they may justly claim, as the owners of the *Inchmona*, to be the possessors of the most economical steamer afloat, the consumption of coal per I.H.P. per hour in that steamer not having averaged more than 1·15 lbs. over the whole period during which she has been at sea, viz., since May, 1896. This reduced coal consumption gives larger available capacity for cargo carrying, which means both increase of earnings and decrease of outgoings. The *Inchkeith* is a handsome steel screw-steamer taking Lloyd's highest class, and is 348 ft. in length, 47 ft. in breadth, and 28 ft. 1½ in. in depth; her deadweight capacity being 5,600 tons on 22 ft. 5 in. draught, which is somewhat more than that of the *Inchmona*. She is of the improved spar-deck type, with large measurement capacity, having poop, long bridge, and topgallant forecastle, with all the cabin, officers', and engineers' accommodation on the bridge. She is fitted with double bottom forward and a deep cargo tank aft, and has a total water ballast capacity of 1,287 tons. The engines are of the same size as those fitted in the *Inchmona*, viz., 17 in., 24 in., 34 in., and two of 42 in. diameter, with a piston stroke of 42 in. The boilers are of the ordinary cylindrical multitubular type, built for a working pressure of 260 lbs, per square inch, and adapted to work with Ellis & Eaves' type of induced draught. In addition to the main feed pumps on the engines, a pair of Weir's pumps are fitted. Feed water filters on Mr. Edmiston's patent are fitted, a Mudd's evaporator, and other specialities. The trial was in every way satisfactory, a speed of over 11½ knots being averaged. After disembarking her visitors, the *Inchkeith* proceeded on her voyage to Barry, where she loads for Naples. It may be interesting to note that Messrs Hamilton, Fraser & Co. are so satisfied with the results obtained from this system that they have now placed an order for another boat, to be fitted with five-crank engines, with Messrs. W. Gray & Co.

Enidwen.—On July 13th the new screw-steamer *Enidwen*, built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. Jones, Cardiff (of which we gave particulars in our launch columns, July issue, page 171) was taken to sea on her official trial trip. A mean speed of 11½ knots was obtained, the trial proving in every way satisfactory. After the trial the vessel returned to Tyne Dock to take in bunkers. She will be commanded by Captain Richards.

Granit.—On July 13th the s.s. *Granit* proceeded on her trial trip in the Firth of Clyde. The *Granit* is a fine single screw-steamer of the well-deck type, having long poop and forecastle. She has been built for cargo carrying purposes by the well-known firm of Messrs. S. McKnight & Co., Limited, Ayr, for Norwegian owners. The dimensions of the vessel are 180 ft. by 30 ft. by 12 ft. 6 in., and she is capable of carrying about 730 tons deadweight on her register tonnage of 240, while at the same time she has a cubic capacity of about 36,000 cubic feet. The *Granit* has been constructed to the highest class of Norwegian Veritas under special survey, having cellular double bottom specially strongly constructed for loading aground and provision for sailing among ice. She has steam-steering gear amidships, steam windlass, powerful steam warping capstan aft and modern powerful steam winches for the quick handling of cargo. After the preliminary run the vessel was put on the measured mile at Skelmorlie. Six runs were taken, and a speed of 10·72 knots was attained, the vessel at the time being fully loaded and in sea-going trim. The machinery has been supplied by Messrs McKie & Baxter, engineers, of Govan, and has also been constructed under Norwegian Veritas rules for the highest class. It consists of a set of triple-expansion engines, 15 in., 25 in., and 40 in. by 27 in. stroke, and a large horizontal return tube boiler working at 160 lbs., also a large donkey boiler for working auxiliary machinery. Special donkey pumps are fitted, as also a large pulsometer for dealing with water ballast. The machinery department is fully up to modern requirements, and is provided with a Harrison's evaporator and feed heater, also a Harris' patent filter, and is in many respects a duplicate of machinery previously supplied for another steamer. During the trials the machinery worked satisfactorily, and the results attained were all that could be desired, being in fact considerably in excess of the guarantees. After completion of the trials the vessel proceeded on her maiden voyage to Plymouth, en route for Norway.

Undine.—On July 14th the steam trawler *Undine*, built by Messrs. M'Kie and Thomson, Govan, for the South African Fisheries Co., Cape Town, had her official trial trip, when a mean speed of 10 knots was made on the measured mile. The triple-expansion engines by Messrs. Lidgerwood, Coatbridge, worked very satisfactorily at 120 revolutions, and indicating 448 H.P. The plant and insulation has been built throughout to the satisfaction of Lloyd's and owners' consulting engineer. The machinery is designed to run long periods with little attention, and is capable of reducing the holds, which have 2,106 cubic ft. of space, to 26 deg. Fahr. in about 12 hours. The captain has a special cold chamber fitted in his mess room aft for preserving the meat in the warm climate. The vessel has been equipped with the latest modern otter trawl gear, and is the best equipped vessel of her kind which has left the Clyde.

Forth.—On July 15th the trial trip of the steam trawler *Forth* took place, and proved satisfactory, a speed of about 10 knots being attained. The vessel was recently launched for Hull owners by the Irvine Shipbuilding and Engineering Co. (Limited), Irvine, and is equipped with all the latest appliances for the North Sea fishing. Her dimensions are: —105 ft. by 21 ft. by 11 ft. moulded, and the engines, which were supplied by Messrs. Muir & Houston, Limited, Glasgow, are triple-expansion, having cylinders 10 in., 16 in. and 27 in., by 20 in. stroke.

Golden Eagle.—On July 15th the steam yacht *Golden Eagle*, 445 tons, the property of Sir Samuel Scott, Bart., designed by Messrs. G. L. Watson & Co., and built by Messrs. Ramage & Ferguson, Limited, Leith, went on her trials in the Firth of Forth, when a mean speed of 13½ knots was obtained on a run from Inchkeith to the May Island. The engines worked throughout with great smoothness, and with an entire absence of vibration. She will leave Leith early in August for the West Highlands.

Elba.—On July 17th the s.s. *Elba*, 1,080 tons, recently launched by Messrs. Ramage & Ferguson, Limited, Leith, for Messrs. James Currie & Co., also of Leith, went on her trial trip on the Firth of Forth. The engines worked perfectly, and a speed of 10 knots was obtained on the measured mile. The trial was in every way satisfactory.

Luciline.—On July 20th Messrs. Sir W. G. Armstrong Whitworth & Co. took this vessel on her trial trip. The vessel is the second tank steamer being constructed by that firm to the order of Messrs. Lane & Macandrew, of London (of which we gave full particulars in our Launch columns, July issue, page 170). She has been constructed under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. The vessel was taken for four runs, and attained the successful speed of 11 knots.

Miscellaneous.

Institution of Naval Architects.—At the summer dinner of this Institution, held at Newcastle on Tuesday evening, July 18th, M. Emile Bertin conveyed an invitation to the Institution to take part in an International Congress on Naval Architecture, to be held next year in Paris. He said: "My lords and gentlemen, if the pleasure which we experience in coming to hospitable England to take part in your professional and social gatherings can be accompanied with a regret, it is that of being able too seldom to invite you, on our side, to these congresses which are of such great advantage to the science of all countries. We eagerly seize then on this occasion the opportunity which the holding of the International Exhibition of 1900 presents. The Committee of the International Congresses to be held during the exhibition is of the opinion that there is nothing of such an essentially international character as naval architecture, whose business is to establish communication between all shores. We propose, consequently, to hold such a Congress, commencing on July 19th, next year. It would not be accurate to say that we merely invite you to this Congress. Much more, we ask for your assistance—the assistance of the first Institution which founded in this country a centre of scientific investigation and study for naval construction. I am charged by the French Minister of Marine to convey to you the expression of his wishes. I need hardly say that I add to these the hopes of your French colleagues, who are happy to be able to give you a rendezvous next year at Paris. We will unite our hopes that the 20th century may be a brilliant one for naval architecture in general, and for the British Institution of Naval Architects in particular."

Steam and Hydraulic Packing.—It is surprising the amount of enterprise shown by manufacturers in these days in reference to the various details connected with engineering, and in no class of goods is this more prominent than that of packing for glands and similar devices. Messrs. R. & J. Rankin, Union Foundry, 22, Manchester Street, Liverpool, have been conducting a long series of experiments, with the view of producing a packing for general use which should be, as far as possible, free from the objections to many of the packings now being used, especially in view of the increasing steam pressures now so common. It is a fault with many packings that if the outer covering gives way, the whole is rendered useless; whilst in other packings, if one strand has worn through, the other strands with which it is plaited are released, and the packing becomes uneven, and thus constitutes a hindrance instead of an aid to the running of the machinery. The makers for obvious reasons do not care to say much as to the composition of this packing, but we understand it is a mixture of asbestos with other important ingredients, including a lasting lubricant and another substance, upon which its success largely depends. We have seen testimonials from important steamship companies who have adopted it after satisfactory trials.

Robert Stephenson & Co., Limited.—The business of this firm has been sold to a new company, whose directors will be:—Sir Joseph Whitwell Pease, Bart., M.P. (chairman, Pease & Partners, Limited), Chairman; Sir Raylton Dixon (chairman, Sir Raylton Dixon & Co., Limited); Sir Christopher Furness (chairman, Furness, Withy & Co., Limited); Joseph Albert Pease, Esq., M.P. (director, Pease & Partners, Limited); Lieut.-Col. Philip Watts (director, Sir W. G. Armstrong, Whitworth & Co., Limited). Henry Withy, Esq. (managing director, Furness, Withy & Co., Limited). The business will be carried on as usual until the new company takes possession.

A Smart Piece of Engineering Work in Middlesbrough.—It will be remembered that an accident occurred recently at the Stockton Malleable Iron Works when a large flywheel gave way, resulting in the stoppage of an important part of the works. It was necessary that a new wheel be made as quickly as possible, and this work has been carried out very expediously by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, of Middlesbrough. The wheel which is 17 ft. 4 in. diameter and weighs 313 tons was completed in 11 working days from receipt of order, and considering that the wheel is a built one with a large amount of work in it, this appears to be an exceptionally smart piece of engineering work.

Messrs. Wood & Newland (late assistants to Messrs. Wheatley, Price & Goulty), have opened offices at 42, Spring Gardens, Manchester, and are prepared to undertake valuations, whether intended for flotation, transfer, adjustment of capital account, debenture or loan securities, probate, or other purposes; to make periodical examination of works and report thereon; also to negotiate partnerships, and sale of works either by private treaty or by public auction.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from June 8th to July 1st, 1899.

11079 W. C. Haynes. Safety hatch for ships.
11083 J. Smith. Metallic packing for pistons.
11100 F. D. Ulzurran. Dredging harbours and canals.
11115 D. M. Bowyer-Smyth. Centre boards for boats.
11126 F. Kruger and J. Krost. Rotary steam engines.
11128 C. M. Johnson. Lifeboat device.
11141 R. Morris and W. T. Gent. Manufacturing iron and steel.
11152 H. F. Swan and A. Hogg. Navigable vessels.
11154 E. J. Davis. Piston-ring pliers.
11161 B. C. Joy. Regulating devices for engines.
11180 A. A. O. J. Brandes. Indicating position of wrecks.
11204 E. S. Bond and C. Lee. Internal combustion engines.
11213 J. and G. W. Clark. Refloating stranded ships.
11226 W. Lowen. Hammocks.
11227 J. P. Hall and G. A. Robertson. Ventilating dynamos.
11238 D. G. Martens. Ships' propellers.
11240 D. G. Martens. Steamships.
11265 C. D. Abel. (H. Eckhardt, Germany.) Engine valves.
11306 H. E. Jones and W. Manning. Pleasure boats.
11316 L. Levi and J. H. Gray Valves for feed pumps.
11336 A. E. Warder. Plug for boats.
11359 A. Marx and W. Dodsceweit. Propulsion of boats.
11363 H. C. Platts and T. Lowther. Steam boilers.
11364 H. L. J. C. Turc. Launching torpedoes.
11367 J. L. M. A. Reis. Preventing incrustations in boilers.
11383 R. Merryman. Steam engine piston-rod.
11388 G. Allen. Boats.
11389 W. E. Proctor. Centrifugal pumps and fans.
11427 M. F. Hill. Bearings.
11428 D. Bacon. Device for steering ships.
11464 M. H. Bowden. Carriage of ships' boats.
11495 W. and A. R. Crawford. Closing watertight doors.
11501 W. Bannister and A. Dunstall. Propeller for boats.
11507 T. Moy. Steam engines and boilers.
11514 J. A. R. Clark. (G. S. A. Ranking, India.) Boat lowering appliances.

BOARD OF TRADE EXAMINATIONS.

Note.—1C denotes First Class; 2C Second Class.

June 24th, 1899.

Alderson, John 1C Cardiff
Alexander, W.F. 2C London
Andrews, Henry 2C ,,
Attwood, Wm. 2C WHrtlepl
Barwick, J. S. 2C N.Shields
Bunny, B. R... 2C Cardiff
Cotton, S. C. .. 1C Glasgow
Dando, Wm. .. 2C WHrtlepl
Davies, Jenkin 2C Cardiff
Daw, H. M. W. 1C London
Denholm, David 1C N.Shields
Forbes, Duncan 2C Glasgow
Griffin, Wm. H. 2C Cardiff
Harris, Peter .. 1C Glasgow
Hipwell, W. H. 2C N.Shields
Hutton, H. R.. 2C London
Jones, Owen D. 2C Liverpool
Kelly, Donald.. 1C Glasgow
Kerr, James .. 1C ,,
King, Alexander 2C London
Knox, Henry.. 1C WHrtlepl
Lambert, J. M. 1C N.Shields
Lamont, Donald 1C Liverpool
Landen, W. H. 1C London
McCallum, W. 1C Glasgow
McMillan, N.M. 1C ,,
Metcalfe, Thos. 1C WHrtlepl
Molineux, A. P. 1C N. Shields
Patterson, H...2C Glasgow
Quenet, A. E... 2C N.Shields
Randall, John 1C Cork
Reid, George.. 2C Glasgow
Ritchie, G. D. 1C London
Rogers, Charles 2C N.Shields
Rogers, J. R. .. 2C WHrtlepl
Roper, Robert 1C Cardiff
Sara, Hedley .. 2C Plym'uth
Scott, John M. 2C Glasgow
Smith, A. J. .. 2C Liverpool
Smith, John .. 1C Glasgow
Suttie, D. W... 2C Dundee
Tunnicliffe, G.F 1C WHrtlepl
Turner, T. H... 2C ,,
Warren, T. B...1C Cardiff
Wight, R. M. ..2C N.Shields
Wyatt, P. J. .. 2C Cardiff

July 1st.

Alison, A. E. .. 2C Glasgow
Axworthy, F... 1C London
Beckley, F. D. 2C ,,
Brown, R. F. .. 1C S'nd'rl'nd
Chapman, E.B. 1C Hull
Childe, Wm... 2C London
Coulouris, T... 1C Aberdeen
Foster, G. W... 2C London
Harper, John.. 1C Liverpool
Jennings, J. W. 2C London
Kelly, Henry.. 1C S'nd'rl'nd
Lawson, W.B.S. 2C ,,
Mac Leod, John 1C Liverpool
McTaminey, C. 1C Aberdeen
Marshall, C. S. 2C London
Milton, Jas. E. 2C London
Power, R. L. .. 2C ,,
Robb, G. McG. 1C ,,
Sim, James .. 1C Aberdeen
Sugdon, H. G. 2C Hull
Tyrer, O. B. .. 2C ,,

July 8th.

Anderson, J. R. 2C N. Shields
Anderson, J.W. 2C Glasgow
Austin, J. T. .. 2C Cardiff
Burley, T. W. 1C N.Shields
Cameron, Wm. 1C Glasgow
Cookson, J. W. 2C N.Shields
Cormack, James 1C Glasgow
Davison, J. D. 2C London
Dayes, Allen .. 2C ,,
Evans, John .. 2C Cardiff
Ferguson, J. .. 1C London
Fitzgerald, C.R. 2C Cardiff
Floyd, Peter ..1C ,,
Furneaux, W. 1C London
Gregson, A.D.K. 2C Liverpool
Hall, Peter.... 1C N.Shields
Harper, James 2C ,,
Holland, L. C. 1C Liverpool
Hopper, A. .... 1C Glasgow
Howell, Charles 1C Liverpool
Jeary, Wm. .. 2C N.Shields
Johnson, T. W. 1C London
Lecoustre, R. . 1C Liverpool
Long, Henry P. 2C ,,
Macris, C..... 1C Cardiff
M'Adam, J. S. 2C Glasgow
M'Combie, N... 2C Glasgow
Matthews Alex. 2C N.Shields
Matthews, F. T. 2C London
Menzies, J. M. 1C ,,
Moore, Chas. E. 1C Cardiff
Nancollas, W.J. 1C ,,
Paxton, Geo. B. 2C Glasgow
Pearson, R.J.B. 2C London
Pickering, W.A. 2C N.Shields
Ritchie, Alex... 2C Glasgow
Robertson, J.T. 2C London
Robertson, J.A. 1C Glasgow
Sadler, H. F... 2C London
Skelly, George 2C Liverpool
Stableford, W H 1C ,,
Strathern, Wm. 1C N.Shields
Strong, George 2C ,,
Surman, J. S. 1C Cardiff
Waters, O. C... 2C ,,
Wills, Ernest.. 2C ,,

July 15th.

Adam, Jas. H. 1C Greenock
Anderson, John 2C ,,
Barrie, Thos... 1C Leith
Bell, Robert L. 1C ,,
Birnie, T. W... 1C N.Shields
Brown, R. H... 2C Greenock
Casement, J. W. 2C Liverpool
Cass, John P... 1C Hull
Crawford, David 1C Greenock
Devlin, W. McL. 2C Liverpool
Edgoose, J. H. 2C N.Shields
Ferguson, David 2C Greenock
Forrester, E. D. 1C Dublin
Galletly, J. P... 1C Liverpool
Gibson, E. A... 1C London
Glass, Chas. H. 2C ,,
Henderson, T. 2C Leith
Hepburn, W.F. 1C ,,
Hogarth, Robt. [illegible]C London
Kelly, John M. 1C N.Shields
King, John P. 1C Hull
Lane, Wilfred 1C London
Marsh, Charles 1C Dublin
McCartney, T. 2C Greenock
McClyment, W. 2C ,,
McMenemey, W. 1C Liverpool
McMillan, R.A. 1C ,,
Millar, Jas. T. 2C Leith
Minikin, J. E. 2C Hull
Naismith, C. .. 2C Greenock
Reid, Robert .. 2C Liverpool
Roberts, W. H. 1C ,,
Smith, Victor E. 1C Leith
Stewart, W.McK 1C Liverpool
Taylor, Alexr. 1C Greenock
Williams, G. A. 1C London
Wood, F. J. .. 1C Greenock
Wright, D. J. 2C Liverpool

The Institution of Junior Engineers.—The Institution of Junior Engineers, of which the president is Sir W. H. White, K.C.B., Director of Naval Construction and Assistant Controller of the Navy, holds its summer meeting this year at Portsmouth and Southampton, commencing August 12th. The Government establishments, engineering works, &c., in the neighbourhood are to be visited, and whilst at Southampton, in addition to the L. and S. W. Railway Co.'s docks, an inspection will be made of the North-German Liner *Kaiser Wilhelm der Grosse*, and the American Liner *St. Louis*. The mayors of both towns are offering entertainment to the institution.

The Marine Engineer.

LONDON, SEPTEMBER 1, 1899.

THE Americans are pushing along their increase of Navy and carrying out the work in their own yards with all the latest improvements in labour-saving tools. We have no doubt they could give our shipyards wrinkles in labour-saving devices, as American workmen have no prejudices about producing any amount of work per man, provided appliances are given them which will enable them to do such maximum work with ease to themselves. We wish our workmen would look at the matter in the same light, but, unfortunately, it is well within the experience of every employer of engineering labour that when special tools and jigs have been provided to enable men to double or treble their output with an advantage to themselves on piecework of even 50 per cent. an increase of wages, they are prevented by their fellow-workmen from availing themselves of the opportunity so beneficial to themselves and their employers, owing to the fear of taking work out of the hands of others. Three battleships are now being built at Newport News, two of which are in the water and nearly completed. Many of the weighty parts, such as the gun turrets, were built and received their armour on shore, and were placed in position by a 150-ton crane. This crane, which is, we believe, the largest in the world, is worked by electricity and is as easy to handle as a motor car. The Newport News Yard has a frontage of half a mile on the James River, and is fitted throughout with hydraulic mains, which may be measured in miles. The hydraulic power is used not only on the ships, both in the slips and in the dry docks, for riveting, hauling, and other usual purposes, but also largely for hand tools—such as for chipping, drilling, &c. Pneumatic hand tools are also used for caulking, and whenever motive power can be substituted for manual labour in any of the usual engineering operations, it is done, and is kindly adopted by the workmen. It is only by the means of such special tools and labour-saving appliances that the high-waged American artisan can produce, as he does, such excellent work at a price not much above the cost of other nations with labour at half the price, and in many cases can even compete with them.

THE Hon. A. C. Parsons is proposing to revolutionise the Navy, as regards at any rate the speed of transit. He considers that 48 knots an hour is within the reach of practical politics where the turbine engine is employed. There can be no doubt that with a practicable rotary engine, such as the Parsons turbine engine, there is practically no limit to the H.P. that such engines can be made to develop in comparatively small space and with little weight of material, compared with reciprocating engines, provided a sufficiency of boiler power can be crammed into the hull. The water-tube boiler has now made this practicable within certain limits of space and weight for boilers and contained water, far beyond what was possible with the old system of boilers. When therefore Mr. Parsons speaks of a light cruiser of 3,000 tons displacement containing 120,000 maximum effective H.P. in the form of water-tube boilers and turbine engines, he speaks of what is at least possible and probably sufficiently practicable for immediate experiment. The coal supply, however, for such power to any radius of action must be immense, as the coal consumption increases as the cube of the speed, and consequently the coal supply per radius of movement will be much increased as compared with present normal or maximum speeds. No doubt the reply to this would be that the greater portion of any required cruise could be traversed with few boilers in use and at a normal or comparatively economical speed, and that the reserve power of such an enormous speed as 48 knots would only be used for a short time for emergencies of defence or offence. Certainly no locomotive torpedo could catch a ship with such a speed, nor could any heavily armed cruisers or battleships approach her unless she were taken unawares. From a commercial point of view, we are of opinion that economical highest rates of speed have already been reached, unless it were for special light mail steamers with small accommodation for passengers who would not mind paying a double or treble rate of passage for highest speed of transit.

THE summer meeting of the Institution of Mechanical Engineers at Devonport was signalised by a paper read by Mr. R. H. Champness, the chief constructor of H.M. Dockyard, Devonport, upon the launch of a battleship. The launch of the *Ocean* was the first case of the launch of a modern battleship from the Devonport slips, it having previously been thought that battleships could not be built at Devonport, the nearest approach to this having been a steel cruiser whose launching displacement was only 2,830 tons, in 1890. The launching weight of the *Ocean* was 7,110 tons, which was a great excess of weight for the old slips, but they have stood the excess pressure so well that during the last twelve months three such ships have been upon the blocks, of which two are now afloat, the third is well advanced for launching, and a fourth is soon to be laid down. Devonport Dockyard has thus fairly established a permanent reputation of being able to build and launch first-class battleships. The weight of the *Ocean* is not a record weight for ships launched from Imperial Dockyards and has been far eclipsed by the Belfast *Oceanic*, whose launching weight was 11,000 tons. Mr. Champness took the opportunity afforded by the record of this launch to bring together into his paper a detailed account of the principles and the work involved in the launch of a large battleship, with calculations of moments, pressures, and buoyancy curves as the vessel is gradually water-borne, which will be valuable as a reference to any reader, and of great benefit to the students in training at the Royal Naval Engineering College at Devonport, for whose benefit indirectly the paper was prepared. The author deals first with building slips, and the declivity of building, and then proceeds to indicate means forcal culation of launching weight, and the movement of the centre of gravity over the slip. Then all details of the groundways cradle are fully detailed and maximum stresses pointed out. The necessity for internal shoring between deck is shown, together with their approved disposition in this vessel. The lubrication of the sliding ways is fully dealt with, including the mode of and material for the lubrication of the various parts. Then come the final preparations of setting the ship, the estimation of the elasticity of the hull in bogging or sogging, and finally the freeing of the dog shores, and the actual launching, with precautions as to leakage when first afloat, and the checking of the velocity of the launched vessel. We have rarely, if ever, seen so interesting a detailed account of the various arrangements and precautions in handling and launching successfully so weighty a mass.

We are sorry to hear that the local Harbour Commissioners of Belfast are standing in the way of their country's good, and the industrial advancement of Belfast by placing obstacles in the way of the legitimate expansion of the magnificent shipbuilding yard of Messrs. Harland & Wolff. We understand that an application by this firm for 40 acres of reclaimed land adjoining their shipbuilding yards, for extension purposes, has been refused. As a result it is said, that the number of employees which would have been engaged by the firm will be reduced by 2,000. Surely when so much is said and done by England to encourage local industry in Ireland, where there is the faintest hope of commercial success, it is a *reductio ad absurdum* that such an opportunity of extension of a well-established and successful business should be checked by the local authorities themselves. *Perhaps* under such repressive treatment Messrs. Harland & Wolff will find it advantageous to cross to the other side of St. George's Channel, where they would be welcomed.

PROBABLY the greatest grievance which the men engaged in shipbuilding in the North of England and Scotland have had to endure, has been lack of employment at various times for long intervals, owing to the depressed condition of their trade. A great proportion of these persons would not have felt this grievance very sorely if they had been anything like sufficiently provident during the busy periods of their industry. Now, for many months during the prosperous period of the shipbuilding industry, the owners of the shipbuilding-yards on the Clyde and the Tyne have been, and are, so busy that they cannot complete their orders within the agreed time in many cases, whilst in other instances they have had great difficulty in doing so, in consequence of the majority of their workmen refusing to labour continuously for six days each week. Notwithstanding the higher wages paid to them, the result has been that very many orders for shipbuilding materials for ships and repairing them have been given to foreigners which would otherwise have been placed with our own countrymen. It has been well stated by a contemporary that the employees are short-sightedly acting against their own larger interests, and are giving to the alien half the loaf when, with energy, they might keep the whole to themselves. British and Irish engineering and other companies who derive much of their income from shipbuilding and ship-repairing are now very reluctant to lay down fresh plant and new machinery to accelerate the completion of the recent rush of orders they have received, as this rush is owing more to the accumulation of arrears in consequence of the recent prolonged engineers' strike than otherwise; and, therefore, after the present busy period has passed, such extra plant and machinery would not be used, or only to a small extent compared with what it now is. This being so, it is well to bear in mind that when foreigners have won a success in a manufacturing business in competition with those engaged in a similar industry at home by the more rapid production by the former of plant and machinery of equal or better quality, and at the same or lower prices, than those of their rivals in the United Kingdom, the foreigners have, as a rule, generally increased their orders at a great ratio annually from the people of this country to the injury of their home competitors and other persons whose pecuniary interests are more or less affected by them. Owing to this result, when slack times arrive in the British and Irish shipbuilding industry, not only will those workmen engaged therein probably have less wage-earning work to do than they previously had as a class during temporary depressions in shipbuilding, in consequence of extra keenness of competition between British and foreign shipbuilders and ship-supplies manufacturers, but this grievance will probably be much, and almost intolerably, aggravated by the new and increasing practice adopted by many large engineering and other manufacturing companies of ceasing to employ even competent workmen who are 50 years of age and upwards. The reason of this new step being taken is to minimise, as far as possible, the risk to which employers are exposed to pay compensation to their workmen for injuries suffered by them in the ordinary course of their employment under the Workmen's Compensation Act of 1897. For these reasons, and the fact that want of employment in and incident to shipbuilding in the North of England and Scotland has resulted in awful distress amongst those workmen and their families who have been seriously subjected to this evil, we feel bound to emphatically state that the recent improvident, reckless practice of shipbuilding employees in these parts of Great Britain of wasting their time and money by not working full time weekly is much to be condemned, and systematic and well-directed efforts should, without delay, be adopted to materially diminish, if not to get rid of, this grievance.

THE MACHINERY OF H.M.SS. "PROSERPINE" AND "PSYCHE."

AS ILLUSTRATIVE OF THE WORK DONE AT KEYHAM, PARTICULARLY WITH REFERENCE TO THE PRACTICAL TRAINING OF ENGINEER STUDENTS.*

By Mr. ROBERT MAYSTON, R.N.,
Chief Engineer, H.M. Dockyard, Devonport..

For some years, in addition to the general work of repairs to the machinery of ships, there has been continnously new machinery in course of manufacture. The ships for which the machinery has been manufactured at this dockyard comprise the following:—

Pheasant	each of 1,200 I.H.P.
Partridge	
Lapwing	
Ringdove	
Phœbe	7,500 I.H.P.
Astræa	9,000 ,,
Talbot	9,600 ,,
Phœnix	each 1,400 I.H.P.
Algerine	
Proserpine	each 7,000 I.H.P.
Psyche	

and at the present time the engines and boilers for H.M.'s sloops *Rosario* and *Vestal*, each of 1,400 I.H.P., are in progress.

The designs are worked out in the chief engineer's drawing office, receive Admiralty criticism and final approval before the work of manufacture is put in hand, and, with the exception principally of the steel castings and larger steel forgings, such as shafts, the various parts of the machinery are made and fitted at the yard. It is thus seen that each entry of engineer students of recent years has, during its course of training, had the opportunity of witnessing the construction of, and taking part in, the manufacture, erection in the shop and on board the ship of at least one set of machinery for a warship, involving the most up-to-date practice of the time.

Of the two latest completed ships above tabulated, the *Proserpine* and *Psyche*, the engines and boilers of both were manufactured at Keyham, but in the case of the first named were fitted on board at Sheerness, whereas in the *Psyche* the whole of the work, both manufacture and fitting on board, was carried out at Keyham. Both are third-class cruisers of a type of which there are several in Her Majesty's navy, either completed or under construction. The machinery comprises in each case two independent sets of triple-expansion engines, each with three vertical cylinders of diameters 20½, 33, and 54 in., the length of stroke being 2 ft. 3 ins, and were designed to obtain with each set 3,500 I.H.P., or 7,000 I.H.P. with both sets, the boilers being worked under air pressure, and the steam pressure available at the engines being 250 lbs. per square inch.

Arrangement of Engines.—The general arrangement of the engines is shown on the illustrations which accompany this paper. Figs. 1 and 2 give views of the engines taken from forward, and Fig. 3 gives a view taken from aft. Figs. 4 and 5 give elevation and plan of the engines, showing sections through the cylinders and disposition of the columns, bearings, &c., and Fig. 6 shows the elevation and plan of the arrangement of the machinery throughout the ship, giving positions of auxiliary engines, &c.

The cylinders are independent castings, the high-pressure and intermediate-pressure unjacketed, and the low-pressure jacketed; the working barrels of the latter are made separately, and the pressure of steam arranged for in the jackets 45 lbs. per square inch.

The slide valves of the high-pressure and intermediate-pressure cylinders are of the piston type; those of the low-pressure cylinders are flat. This arrangement is very generally adopted, one reason being that with the flat valves there is less liability of leakage past them into the condensers. The side gear comprises the ordinary double eccentrics and links, with steam-starting as well as hand-starting gear. There is a cast-metal surface-condenser O to each set of engines, the circulating water passing through the tubes; the circulating pumps are of the centrifugal type, and designed to be each capable of discharging 600 tons of water from the bilge per hour with steam of 200 lbs. pressure per square in., and exhausting into the atmosphere. Balance weights are fitted to the high-pressure and low-pressure cranks, and on the trials of the ships there was found to be practically no vibration, there being complete steadiness of engines at all speeds. The propellers are three-bladed, of the modified Griffiths type, and the blades are of manganese bronze. Diameter of propellers 10 ft. 7 in., pitch at which set when tried 11 ft. 3 in.

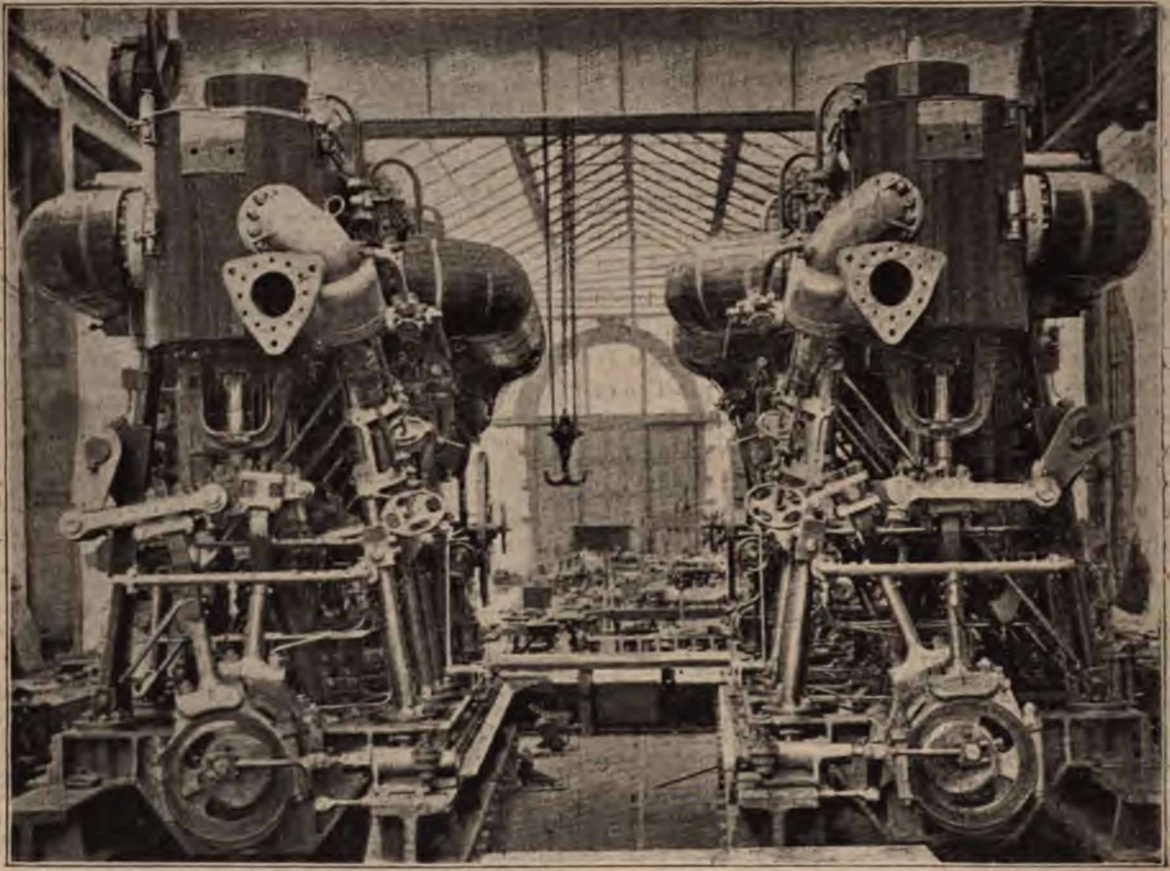
Boilers.—The general disposition of the boilers B is shown on Fig. 6 of the general arrangement of the machinery throughout the ship. There are two boiler rooms, containing eight water-tube boilers of the Thornycroft type, capable of being worked at a pressure of 300 lbs. per square in. The total area of fire-grate is 350·4 square ft., and the total surface of generating tubes is 19,515·5 square ft. The whole number of generating tubes in these boilers is 8,752, varying in diameter from 1⅛ to 1¼ in., the thickness of each tube being 0·116 in. All tubes are zinc-coated by electro-deposition on the outside, and are solid drawn by the cold process. The tubes are secured to the collector plates by the ordinary method of expanding. Water-pressure tests of 450 lbs. per square in. were applied to the boilers after manufacture in shop, again when placed in ship, and again after trials. Fig. 7 gives a view of one of the boilers as built up in the boiler shop. Four independent feed-pumps are fitted, two main and two auxiliary, all of the Weir type. The main and the auxiliary feed-pumps have independent systems of delivery pipes and feed valves, and the arrangements are such that each of the pumps is capable of feeding any of the boilers. An automatic feeding apparatus is fitted to each boiler, which, with the slow-moving feed-pumps, provides a very efficient arrangement for maintaining a strictly uniform water-level. Steel is the material used in the main leads of steam pipes, and the pipes are coated externally by electro-deposition of zinc.

---

*Read at the Plymouth meeting of the Institution of Mechanical Engineers. Sir William H. White, K.C.B., LL.D., in the chair.

Forced Draught.—There are eight fan engines F for forced draught purposes, which on the forced draught trials were capable of maintaining an air pressure of 3·7 in., with mean revolutions per minute 663.

Additional Machinery.—The machinery, apart from the main engines and boilers, comprises the following:—Two electric-light engines E, (Fig. 7,) one steering engine S, one capstan engine, two reversing engines, eight forced-draught fan engines F, four ash hoists J, one air compressor A, two main circulating engines C, two main feed engines M, two auxiliary feed engines X, two fire and bilge engines G, two hot-well engines H, two distillers D.



MACHINERY OF H.M.S. "PSYCHE," FIG. 1. VIEW FROM FORWARD.

Prior to the boilers being placed in the ship, one of the type was tested to ascertain if its evaporative power would meet the specified requirements, steam pressure being maintained at 300 lbs., and steam exhausting into the atmosphere at that pressure. Particulars of results were as follow:—

Area of fire grate	43.87 sq. ft.
Total heating surface	2,563·5 ,,
Steam pressure	300 lbs.
Mean air-pressure	3·2 in. of water.
Fan in use	1 in No.
Diameter of fan	5 ft. 6 in.
Revolutions of fan per minute	544.
Consumption of coal per hour	2,920 lbs.
,, ,, per sq. ft. of fire grate	66·56 lbs.
Thickness of fire	6 in.
Total water evaporated per hour ..	19,210 lbs.
Water per pound of coal from temperature of feed water	6·58 lbs.
Equivalent evaporation from and at 212°	8·10 lbs,
Temperature of funnel	841°.

As is usual with H.M.'s ships, on completion the machinery was subjected to a series of trials which were required to be carried out to the satisfaction of the Admiralty Inspecting Officers. These trials comprised the following:—(1) A basin trial; (2) a preliminary trial at sea; (3) a trial of 30 hours' duration at 3,500 I.H.P.; (4) trial of eight hours' duration at 5,000 I.H.P.; (5) a four hours' trial at maximum power, during which the power obtained was required to be not less than that specified nor more than 5 per cent. above it.

A summary of the results obtained on the trials of the two ships is as follows:—

THIRTY HOURS' TRIAL AT 3,500 I.H.P.

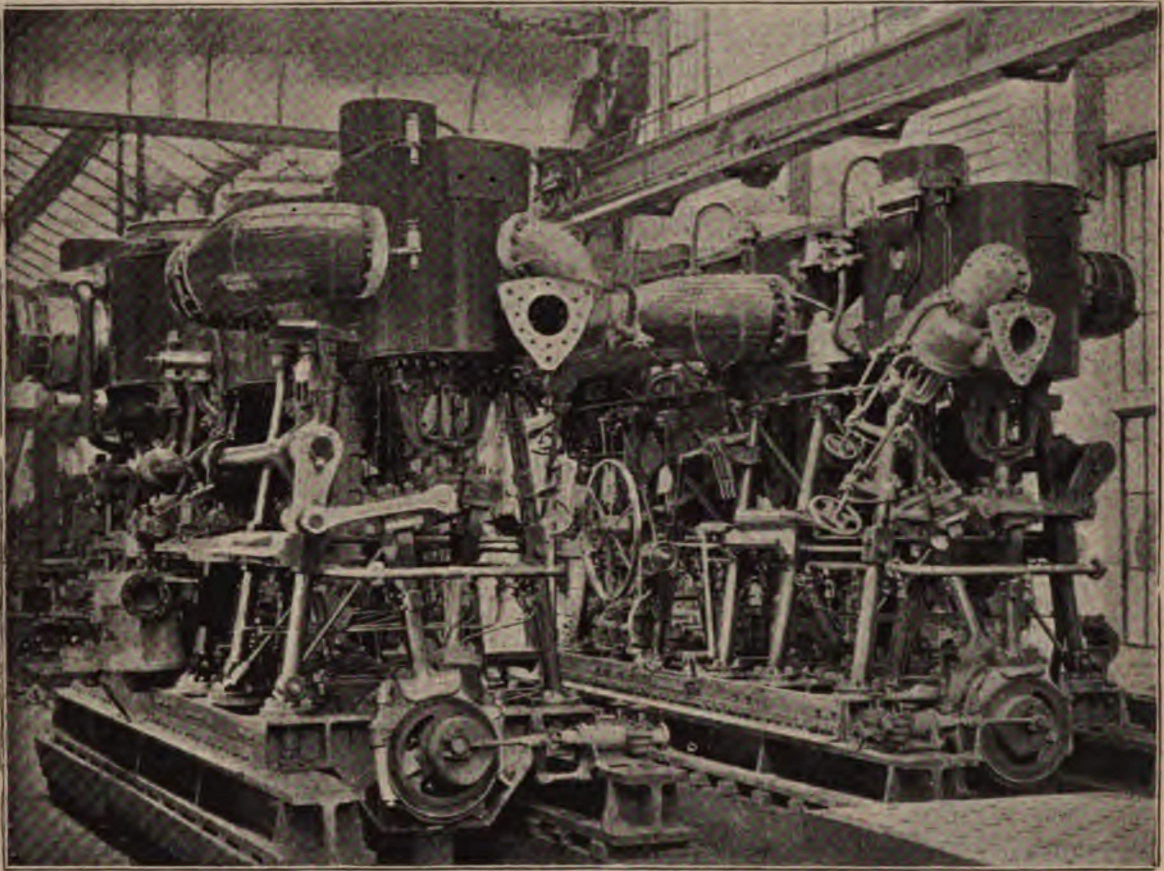
	Proserpine.	*Psyche.*
Pressure of steam at Engines ...	210	215
Vacuum in condensers, Starboard	25·7	26·3
,, ,, ,, Port ..	26·7	25·3
Revolutions per minute, Starboard	169·2	171·2
,, ,, ,, Port ..	168·3	170
I.H.P., Starboard	1,755	1,835
,, Port	1,889	1,811
Total H.P.	3,644	3,646

EIGHT HOURS' TRIAL AT 5,000 I.H.P.

	Proserpine.	*Psyche.*
Pressure of steam at Engines ..	243	234
Vacuum in condensers, Starboard	26·1	27
,, ,, ,, Port ..	25·8	26
Revolution per minute, Starboard	195	194·4
,, ,, ,, Port ..	193·5	193·6
I.H.P., Starboard..	2,674	2,576
,, Port	2,662	2,522
Total H.P.	5,336	5,098

FOUR HOURS' TRIAL AT 7,000 I.H.P. (FULL POWER).

	Proserpine.	*Psyche.*
Pressure of steam at Engines ..	246	235
Vacuum in condensers, Starboard	25·1	26·4
" " " Port ..	24·2	24·4
Revolution per minute, Starboard	222·7	217·6
" " " Port ..	220·5	218
I.H.P., Starboard	3,636	3,558
" Port	3,509	3,473
Total H.P.	7,145	7,031



MACHINERY OF H.M.S. "PSYCHE," FIG. 2. VIEW FROM FORWARD.

The usual stopping and starting trials to test handiness of machinery were satisfactorily carried out, and all auxiliary machinery tested to ascertain its full compliance with requirements. An important condition attending these trials is that the water in the boilers must remain fresh throughout. It was required that, should there be any admixture of sea-water, the cause must be ascertained and the trial repeated after the necessary adjustments have been made. The freshness of the boiler-water and feed-water is determined by the nitrate of silver test, and by the use of a special sensitive hydrometer. Also on the thirty hours' trials at 3,500 I.H.P., it was required that all losses of fresh water caused by steam and water-leakage should be made good by the evaporating plant.

On conclusion of the trials above enumerated, the machinery was opened up in the usual manner for examination and for the satisfaction of the inspecting officers. Also a water-pressure test of 450 lbs. per square in. was applied to the main and auxiliary steam pipes, and all joints were found to be perfectly tight. The low-pressure cylinder-jackets were also tested to 150 lbs. pressure with similarly satisfactory results.

The opening up was satisfactory, and everything appeared to indicate durability and efficiency.

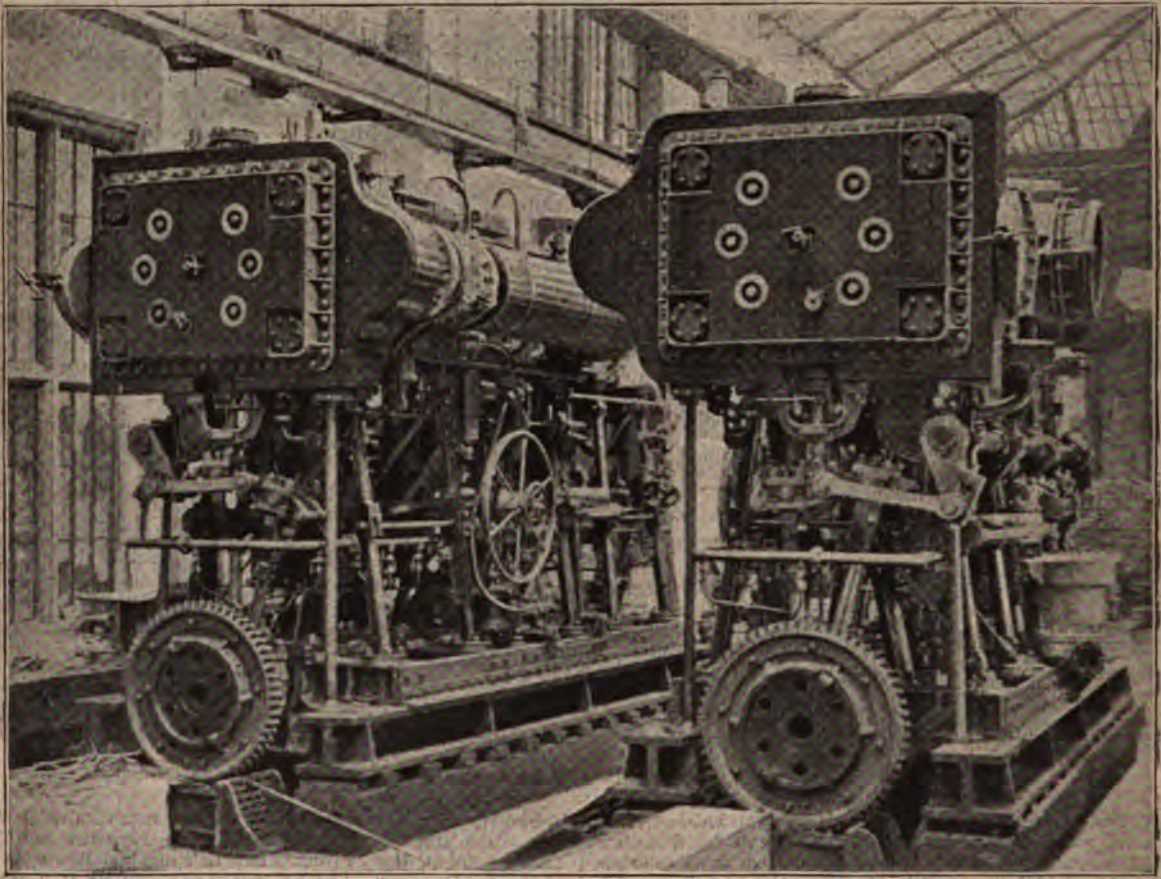
Further Trials.—Subsequently to the opening up and after the ships were commissioned, a further trial of three hours' duration took place; the power authorised was 5,000, and the following were the results obtained :—

	Proserpine.	*Psyche*
Pressure of steam at Engines ..	239	235
Vacuum in condensers, Starboard	25	27·8
" " " Port ..	23·8	25·2
Revolutions per minute, Starboard	186·5	195·8
" " " Port ..	186·5	194·2
I.H.P., Starboard	2,501	2,609
" Port	2,600	2,538
Total H.P.	5,101	5,147

Shortly after the completion of the commissioning trials the ships left England for the North America and West Indies Station, the *Proserpine* last year and the *Psyche* in May of the present year. The procedure as regards these two ships was practically similar to that carried out in all new ships, and illustrates the tests to which machinery is subjected before being finally accepted by the Admiralty, whether the machinery has been manufactured by a private firm or at a dockyard, and before the ships are permitted to depart on home or foreign service.

Training of Engineer Students.—The *Psyche's* machinery, as well as that for other ships previously constructed or now under construction at Keyham, has afforded excellent opportunities for the efficient training of the engineer students, who are being instructed both theoretically and practically to enable them to become engineer officers in the Royal Navy. For the last 11 years Keyham has been the only Admiralty training ground for these officers. The number of students at the present time is 192. An entry is made once each year, during the first or second week in July, following a competitive examination held by the Civil Service Commissioners in the previous April. The period of training is five years. Throughout this time they undergo an educational course at the Royal Naval Engineering College under Professor Worthington, whilst their practical training is obtained in the dockyard at Keyham, and the work they perform is as far as possible real. They take a considerable part in the repair and manufacture of machinery, and in the cases of the two ships which have formed the basis of this paper they have had a very large interest, more so in the *Psyche*, for the reason that they have been able to follow the manufacture of her engines and boilers right through to the time of the ship going to sea, whereas in the *Proserpine*, as previously mentioned, the engines and boilers were sent to Sheerness to be fitted in that ship, and the experience to be gained by seeing them fitted on board was not obtainable.

As illustrating the part taken in the manufacture of new machinery, reference need only be made to that of the *Psyche*, and the following work was entirely carried out in the engineer students' fitting shop:—The two surface-condensers were tubedand tested; the two fire and bilge engines, eight fan-engines, two hot-well engines and pumps, two circulating engines and pumps with auxiliary air-pump, and the two reversing-engines in connection with the slide-valve gear, were completely fitted up from the rough forgings and castings, including all machine and fitting work. In addition, a large number of minor fittings, such as cocks, valves, &c., passed through the hands of the students. It should be noted that the work just enumerated is an indication of what is performed by the students in the early part of their training, that is, during the first half of it, and its class is such as to offer every possible attraction for a student commencing a marine engineering career; at least this is the object aimed at, and, judging by results, there is every reason to assume it has been successfully attained.



Machinery of H.M.S. "Psyche," Fig. 3. View from Aft.

Fig. 8 is a plan of the workshops at Keyham, showing the position of the fitting shop appropriated for the training of the engineer students relatively to the principal fitting shops of the *chief engineer's department*. It will be seen that they are so close that the students are enabled to watch any erection of new machinery; in fact, it is part of their instruction to be shown the nature of the work as it progresses, and they are afforded every facility.

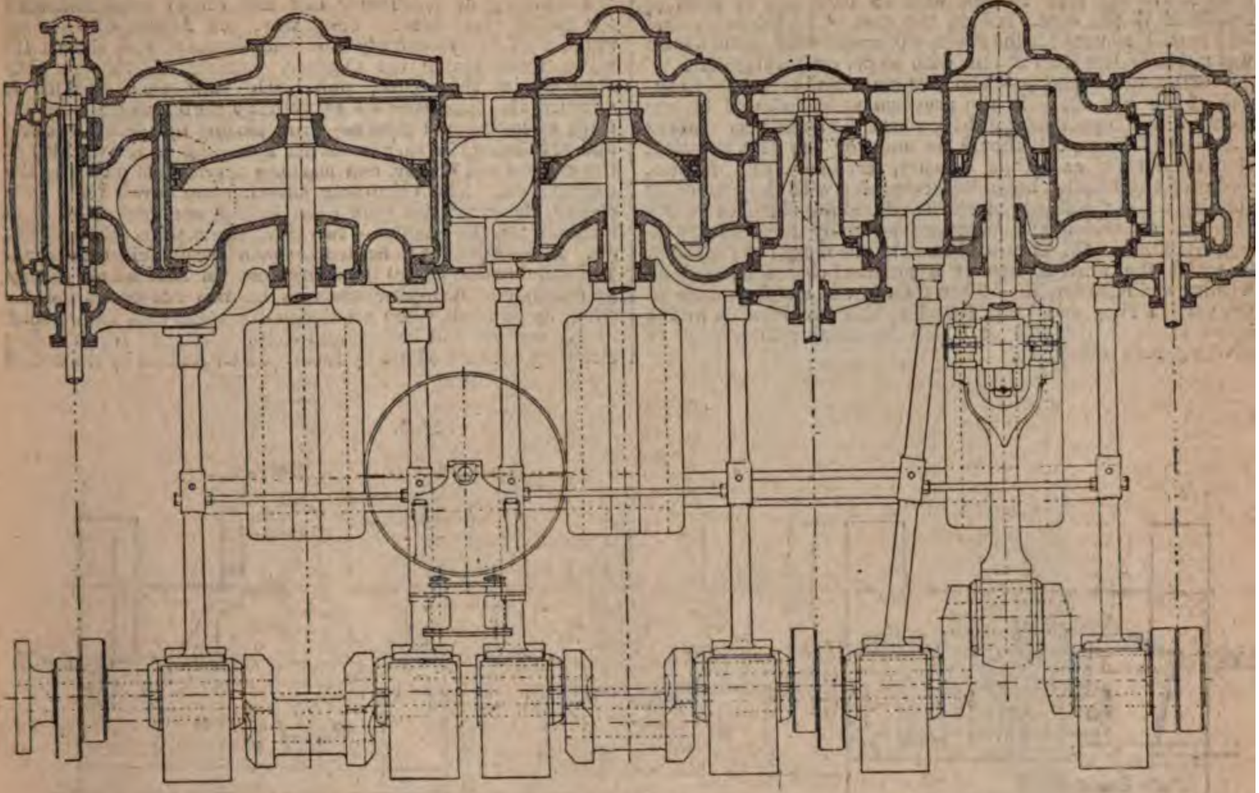
It may be of interest to give the exact training an engineer student undergoes at Keyham during the five years he is under instruction preparatory to his appointment as an assistant engineer, Royal Navy.

First year's Training.—On entry he is engaged on practice work with the hammer and chisel, and after a short time commences engine fitting (useful work).

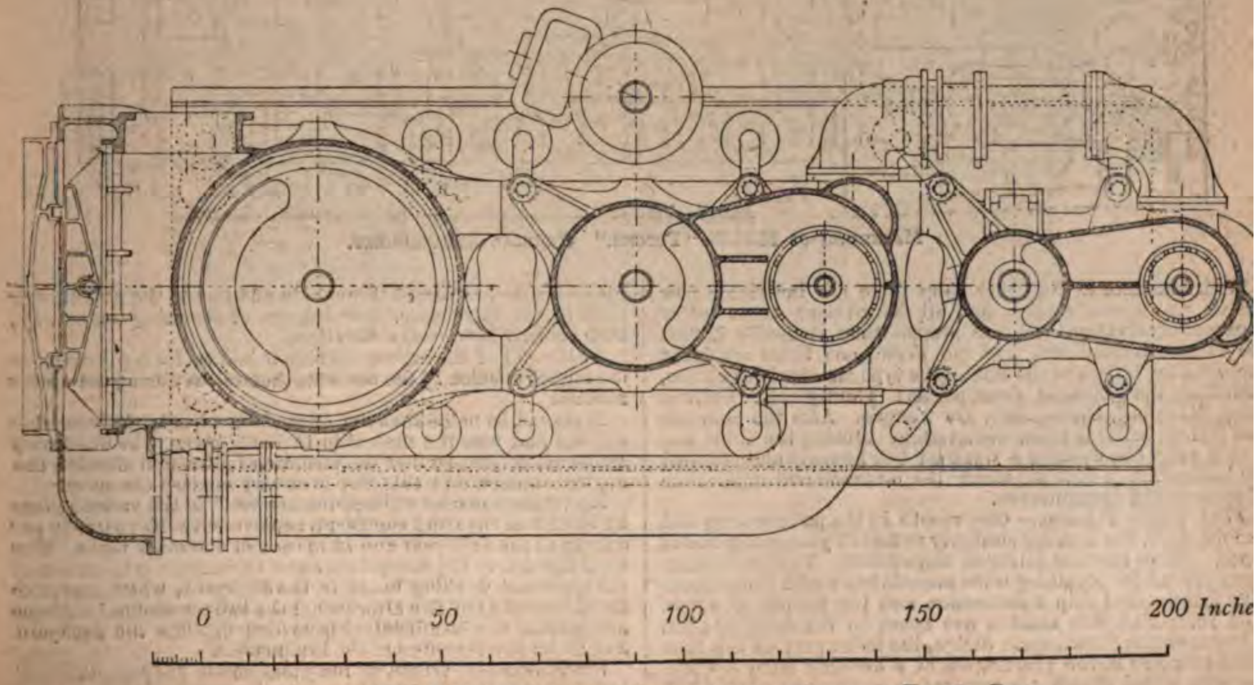
Second year's Training.—For nine months he is employed at the lathe, and the remaining three months at other machines. During the second year a half-day per week for the greater part of the year is spent in sketching details of machines and parts of machinery.

Third year's Training.—Eight months are spent n engine fitting in the students' shop, one month he is sketching details and learning the principles of construction of machinery used in connection with the discharge of torpedoes, such as air-compressing machinery, torpedo tubes both submerged and above water (the latter as made and placed on board the *Psyche*), and the remaining three months he is employed on repairs to engines, &c., of ships afloat, or as the opportunity presents itself, such as in the case of the *Psyche*, in fitting new machinery in ships.

It may here be observed that the testing machine for materials is placed in the students' fitting shop, and arrangements are made for the students in turn to become acquainted with the tests and the methods of carrying them out and of recording them, all very important matters in connection with an engineer's training. All the materials used in the manufacture of the *Psyche's* engines were so tested in order to ascertain if they complied with requirements as laid down in specification; for



MACHINERY OF H.M.S. "PSYCHE." ARRANGEMENT OF ENGINES. FIG. 4. ELEVATION


0
50
100
150
200 Inche

MACHINERY OF H.M.S. "PSYCHE." ARRANGEMENT OF ENGINES. FIG. 5. PLAN.

instance, in the case of the gun-metal used the tensile strength must not be less than 14 tons with an extension in 2 in. of length of 7½ per cent., and in the case of high-tension cast bronze such as used for the *Psyche's* propeller-blades the tensile was not to be less than 28 tons with 15 per cent. extension.

Fourth year's Training.—The first six months are a continuation of the last three in the previous year, followed by one month in the coppersmiths' shop, where the short time renders it necessary their work should be more or less of a practical character, such as fitting patches, branches, and flanges, soldering and brazing, becoming acquainted with the method of running white metal into bearings and making sketches of the principal apparatus and processes generally appertaining to coppersmiths' work. This is followed by one month at smithing, in which the work is also of a practical character, such as welding and light forging. Then follows one month in each of the pattern shop and brass foundry, and two months in the boiler shop, in the last of which he obtains knowledge of riveting, tube rolling, &c.

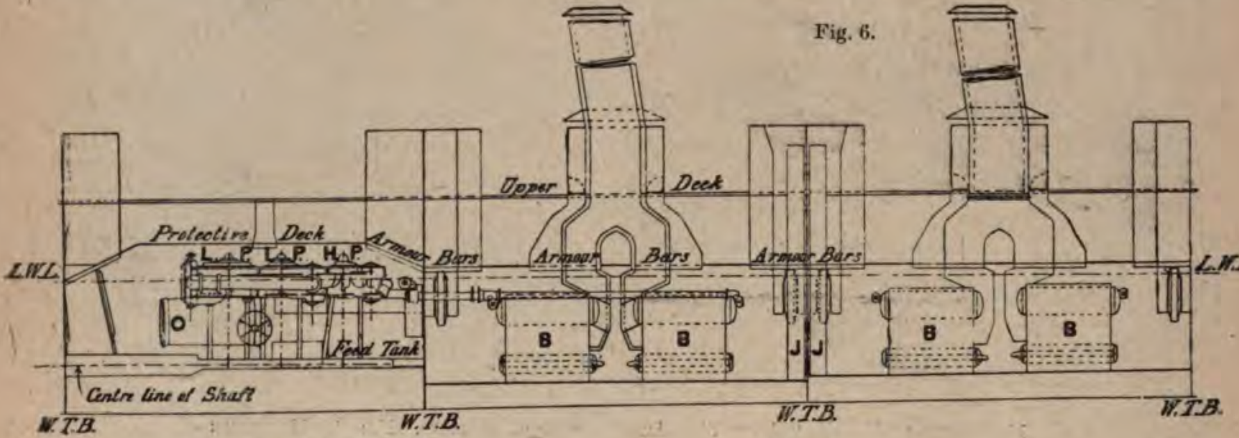
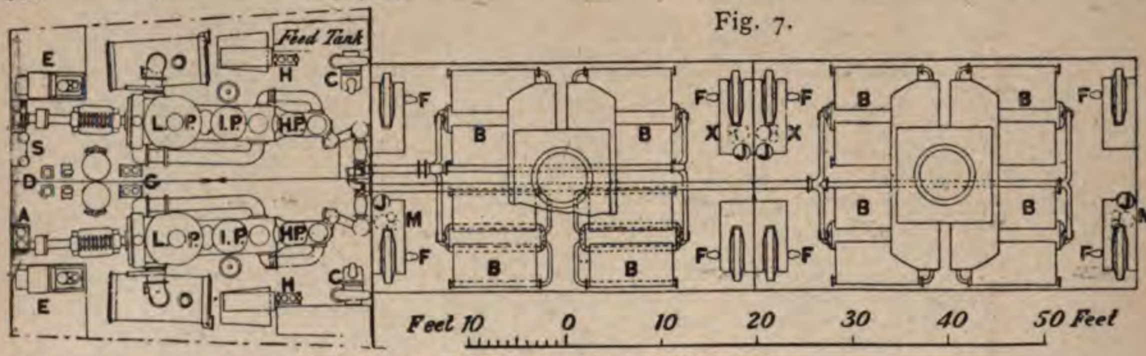


Fig. 6.

Fig. 7.



MACHINERY OF H.M.S. "PSYCHE." GENERAL ARRANGEMENT.

With reference to the boiler shop there are invariably new boilers under construction, and all descriptions come under repair or observation. At the present time Belleville boilers are being manufactured for the *Vestal*, and tubes are being prepared for boilers of the small-tube type already in existence, including the following descriptions: Thornycroft, Yarrow, Reed, Mumford, Blechynden, Du Temple. Also the Babcock and Wilcox boiler is under observation. During the third and fourth years one evening a week for two hours is appropriated for instruction in drawing under the direction and supervision of experienced draughtsmen.

Fifth year's Training.—One month in the pattern shop and one month in the foundry similarly to fourth year, doing useful work. Three months' fitting on ships afloat. Two months are appropriated for obtaining some acquaintance with the elementary principles of ship construction and the fittings of ships. The remaining five months are spent in the drawing-office learning engine drawing and design, the latter part of the time being occupied in the preparation of a drawing from his own sketches, which drawing is required to be done to enable him to pass into the Navy.

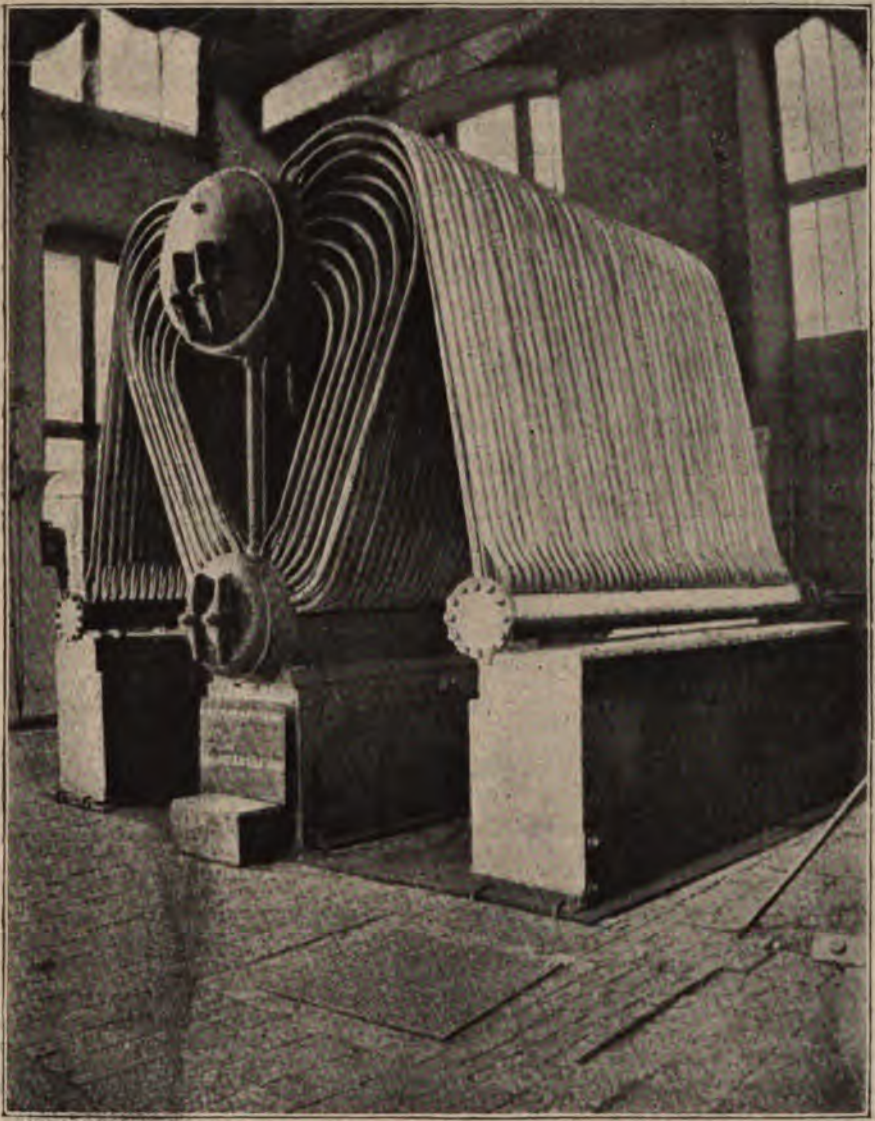
In order that the students may become acquainted with the working of machinery and the duties connected with the engine room when under way, the Admiralty have set apart H.M.S. *Sharpshooter* for the purpose, and classes are taken from March till October. During March the ship steamed in the basin, and each third-year student is afforded the opportunities of actually performing the operations of laying and lighting fires, getting up steam, opening and regulating the various valves, attending to the working of the engines and boilers, and learning the various duties of the engine room. The third-year students are divided into four classes, the course for each class lasting one week, four days under steam, the remaining two days for repairs, examination, &c. From April 1st to September 30th (except during examination and vacation times) the *Sharpshooter* is steamed under way by fourth and fifth-year students on two afternoons and one whole day a week, when all duties connected with the working of the engines and boilers and examination and repairs after steaming, are carried out by them. Each student by the end of his fifth year has passed through, in addition to the preliminary stage in the third year, four courses of steaming under way, each course of two weeks' duration.

At the end of the season the ship is laid up for repairs, which are largely effected by the students themselves during the winter months.

It should be noted that the *Sharpshooter* has triple-expansion engines and was the first ship in H.M. Navy to be fitted with Belleville boilers, so that the steaming instruction afforded the engineer students by this ship is of very modern character.

Lectures on marine engineering are given to the various years by officers of the chief engineer's department at Keyham, 18 per annum to the fifth year and 12 to each of the other years. The time devoted to the *Sharpshooter* and to lectures is taken out of the students' working hours in the dockyard, which comprise four forenoons and five afternoons; the two remaining forenoons are devoted to educational subjects distinct from the dockyard and under the direction of the headmaster.

Sir William H. White, in his presidential address, delivered to this institution in April last, gave the various descriptions of machinery with which the modern warship is now supplied, and it goes without saying that with the growth of this machinery the necessity has increased for giving the officers who will be mainly responsible for its efficiency every opportunity for becoming familiar with it, and of becoming up-to-date naval engineers.



Machinery of H.M.S. "Psyche," Fig 8. One of Boilers.

The facilities afforded at Keyham for the acquirement of a thoroughly practical training place the Royal Naval Engineering College in the foremost rank as an institution for obtaining a sound knowledge of mechanical engineering. The fact that as soon as possible after entry the student is employed on useful work, the various courses of instruction which are arranged to render the knowledge of marine engineering obtained as complete and as comprehensive as possible, the facilities afforded for acquaintance with running machinery, the constant contact throughout the training with experienced workmen, the frequent opportunities afforded for obtaining information from the officers who have charge of the training, all go to indicate that nothing is spared to make the training of the engineer student as complete as possible.

It has been thought that the subject could be best placed before the members of the Institution of Mechanical Engineers by associating the manufacture of the machinery of H.M.SS. *Proserpine* and *Psyche*, in which the students themselves have had considerable interest, with a description of the training undergone. It only remains to say that a better idea can be obtained by a personal inspection of the workshops at Keyham and the Royal Naval Engineering College itself, and that it will be considered a privilege to give the members of this institution any further information desired.

Hartmann's Rahtjen's Improved Composition.—The latest additions in the way of first-class battleships for her Majesty's Navy, namely the *Venerable*, *London*, and *Vengeance*, are coated with Hartmann's Rahtjen's Improved Composition (The Red Hand Brand).

Messrs. Denny & Brothers have been commissioned by the Russian Volunteer Fleet to build and engine a twin-screw steamer for passenger and cargo service, and of high speed. The new vessel, which is to be named the *Poltara*, is to have water tube boilers of the Belleville type, four cylinder engines, and is to have a speed of close on 20 knots. The cost of the vessel, which is to be ready for delivery in the spring of 1901, is estimated at 3,000,000 roubles or about £450,000.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

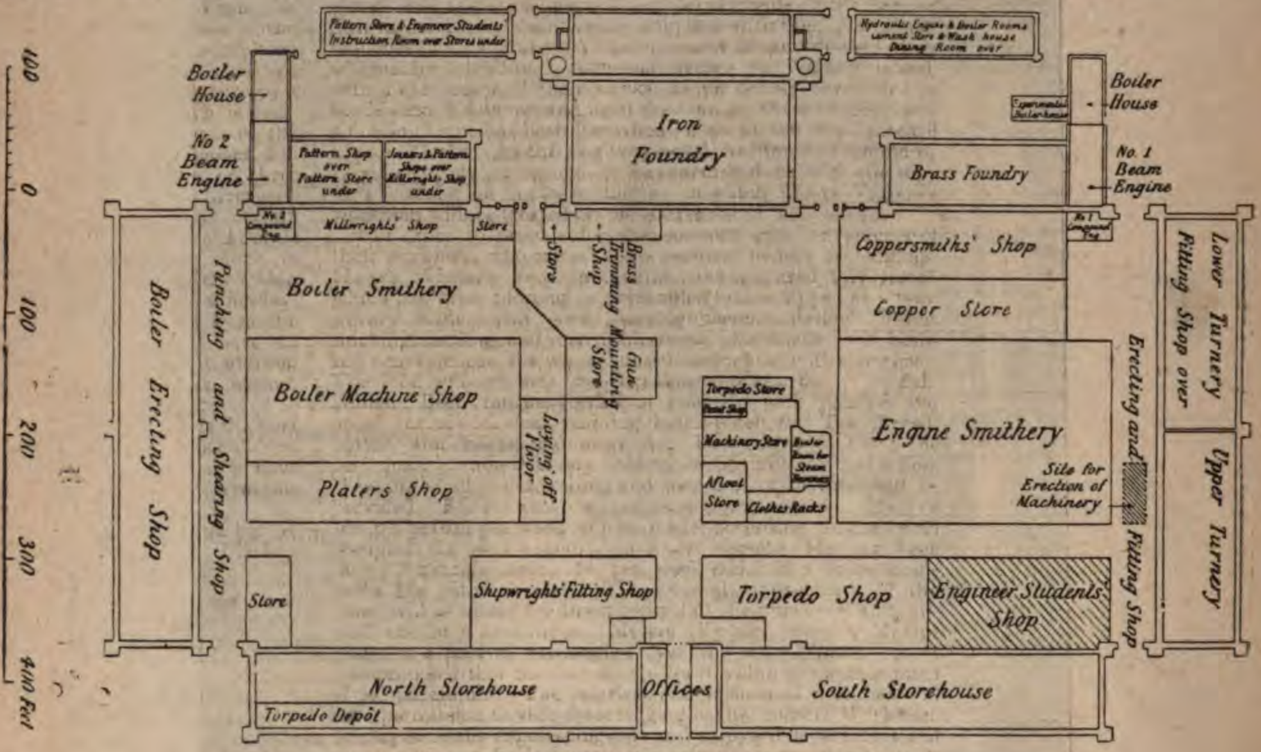
The Paris

is indeed an unlucky ship. After spending about two months in provisional repairs at Falmouth, it was decided that she should go to Milford Haven for the purpose of being dry-docked and so having the real extent of her injuries ascertained. This seems to be the last straw in the ship's misfortunes, for Milford luck is by this time almost proverbial. Anything that goes to that port seems to leave its good fortune behind it. We have just seen an example of this in the case of the Canadian Steamship Company and their unlucky *Gaspesia*. Perhaps it may be in the case of the *Paris* that it will be a change for the better. At all events it is said that the vessel is less damaged—as far as can be seen—than the most sanguine dared to hope. She started on her voyage from Falmouth on the morning of the 14th August in tow of three salvage boats. On getting clear of the harbour she was able to use her own engines in aid of the tugs. The flotilla passed the Lizard shortly after noon on that day, and reached Milford shortly before mid-day on the 15th. On Friday, the 17th, she was safely bestowed in a wet dock.

Attention may well be directed to a case recently tried before the judge of the Falmouth County Court. It arose out of the stranding of the *Paris*, and was a salvage suit brought by certain local pilots for services rendered to that liner on the night when she took the rocks. The claimants alleged that they saw the *Paris* coming full speed for the Manacles rocks. They signalled to her as well as they could, and she thereupon altered her course so that, instead of striking as did the ill-fated *Mohegan*, she ran on to Lowland Point, where, as the event has proved, salvage was possible. The claim was defeated; for the officers asserted that they took no heed of the signals, believing themselves miles away from any danger, and it was decided that the coincidence of the waving of the pilot boat's light and of the steamer's alteration of course was quite fortuitous. The navigating officers of the *Paris* said they took the signals for the customary pilot signals, which in the ordinary course are constantly displayed to such vessels, and as constantly disregarded by those who do not need the services proffered. The rights and wrongs of the case itself do not seem to be very important, save to those immediately concerned; but it certainly would appear that from this and other cases within one's recollection there is a need for some simple and unmistakable signal which shall convey at once to a fast moving steamer the fact that she is running into danger. In more than one recent case the existence of such a method of communicating a warning would have averted enormous loss of life and property.

The Gorsedd,

of Cardiff, a fine large steel cargo boat, which was stranded at Ile de Seine at the end of July—though only built on the Clyde in 1894—had previously encountered serious trouble. She sailed from Kutchinobzu in November, a year after her launch, on a voyage to Port Townsend, and encountered very heavy weather. She was so seriously delayed that as much as sixty guineas premium was paid for reinsurances in respect of her ere she was reported. Meanwhile, in a gale which she encountered a week after her sailing, no less than 57 of the tubes in her boilers had burst.' When Mr. William Allen and those who are with him speak of the failure of the water-tube boiler, they should remember, or, if they never knew of the fact, should be told of, such experiences as these with the present Scotch type to which he is so superstitiously devoted.


Pattern Store & Engineer Students' Instruction Room over Stores under
Hydraulic Engine & Boiler Rooms Cement Store & Wash house Dining Room over
Boiler House
No 2 Beam Engine
Pattern Shop over Pattern Store under
Joiners & Pattern Shops over Millwrights' Shop under
Iron Foundry
Brass Foundry
Boiler House
No. 1 Beam Engine
No 2 Compound Eng.
Millwrights' Shop
Store
Store
Shop
Brass Trimming Mounting Store
Gun Store
No 1 Compound Eng.
Coppersmiths' Shop
Copper Store
Boiler Erecting Shop
Punching and Shearing Shop
Boiler Smithery
Boiler Machine Shop
Platers Shop
Laying off Floor
Torpedo Store
Paint Shop
Machinery Store
Boiler Room for Steam Hammers
Afloat Store
Clothes Racks
Engine Smithery
Site for Erection of Machinery
Erecting and Fitting Shop
Lower Turnery Fitting Shop over
Upper Turnery
Store
Shipwrights' Fitting Shop
Torpedo Shop
Engineer Students' Shop
North Storehouse
Torpedo Depôt
Offices
South Storehouse
100
0
100
200
300
400 Feet

MACHINERY OF H.M.S. "PSYCHE." PLAN OF KEYHAM FACTORY.

The White Star Line

has disposed of its steamship *Belgic*—second of the name—and she has passed into the hands of the Atlantic Transport Company. Her new name is *Mohawk*, and she is appointed to take the outward sailing from London to New York for her new owners on the 7th September. The vessel in question when new made a voyage or two on the Atlantic, but she has been employed almost the whole of her time in the San Francisco, Yokohama, and Hong-Kong service, where she acquired some considerable popularity. She was built at Queen's Island in January, 1885, and is—as were other vessels of her date—a single screw with engines of the compound type. Her gross tonnage is but 4,212 tons, so that she is somewhat smaller than the general run of Atlantic Transport Liners.

The *Oceanic* arrived at Liverpool on the 26th August, and will make her first departure from the Mersey on the 6th September. Very little has transpired as to her internal arrangements down to the time of writing. The decoration of the public rooms is said to be exceptionally fine, and the builders have again followed the arrangement adopted in the *Majestic* and *Teutonic*, whereby the library is placed above the saloon, with a large ground-glass tableland in its centre covering the usual central dome. The saloon is a very large room, being capable of seating no less than 400 persons at once. There has been a great deal of attention paid to the geography of the ship, as indeed is most necessary when dimensions are so large, so that the minimum of running about may be given to the stewards. There has also been made exceptional provision for the accommodation of the wealthier class of travellers. For American millionaires there are luxurious suites of cabins, and even, in this department, a subsidiary corridor of maids' rooms, so that their private attendants may always be within call of the lady travellers.

The *Medic*, which inaugurated the service from Liverpool to Australia for the White Star Line on the 3rd August, took out a very satisfactory amount of cargo and a good number of passengers. She is to be followed on the 7th September by the sister ship *Afric*, which vessel has already made a trip to New York and back early in the present year.

Southampton

is contemplating the further expenditure of money at the docks, though, as far as can be seen, local capitalists do not directly engage in the development of the port. The latest scheme is the building—by a company subsidiary to the South-Western Railway—of a warehouse with cold storage to the extent of 21,730,000 cubic feet. The idea is that the port should obtain a large proportion of the dead meat, fruit, and cattle trades. As regards cattle and dressed meat the promoters state that they have obtained promises from importers and shipping companies that they will make Southampton their headquarters when the company is ready to commence its operations. They believe as regards fruit that they have two strings to their bow. One is the preserving in cold storage, till favourable opportunities, of the fruit which already comes to our markets and of which there is a glut during a few weeks in the year. The other is the dealing with that which is to come from the West Indies in place of the sugar which can be no longer be grown there at a profit. As reported,

The West India Mail Contract

comes to an end at the end of June next. Already tenders for the execution of a new service are being sought by the Post Office, and it may very well be—in view of the arrangements which are being made for fruit lines from these colonies—that a very radical alteration may be made in the conveyance of these mails and in the Royal Mail Company's relation to the Post Office.

Under the title of

A Big Deal,

we last month mentioned the sale by the New Zealand Shipping Company of four of its vessels to the British India Steam Navigation Company. This is not the only large operation in which the companies with which Sir Edwyn Dawes is concerned have recently been engaged. His New Zealand Shipping Company has by tender bought from the liquidator of the Canadian-Australian Royal Mail Steamship Company, Limited, as a going concern, the fleet, good-will, and other property of the business in liquidation. The three steamers comprised in the fleet are the *Miowera* and the *Warrimoo*, both specially built for the service in 1892 at Newcastle by Messrs. C. S. Swan & Hunter, and the *Aorangi*, a vessel built nine years previously by Messrs. John Elder & Company, of Fairfield, for the New Zealand Shipping Company itself. The whole has changed hands at the price of £145,000. We find on looking into the statement of accounts of the Canadian-Australian Line that the cost of the *Warrimoo* and of the *Miowera* was £75,000 each, and that the *Aorangi* when new cost £127,000. She cost the defunct company, however, but £35,000. On obtaining her they had her re-engined and reboilered, and practically rebuilt in her passenger accommodation. What the exact cost of these improvements and of sending her out to her station may have been, it is difficult to say; for the official receiver put it at £67,000, whilst Mr. Huddart corrected the figures and wrote that the loss on her at the time the company went into liquidation was but £6,000 or £7,000. At all events, the *Aorangi* seems to have been a very costly purchase to the Canadian-Australian Line. It is reported that the New Zealand Shipping Company is ordering four 10,000-ton steamers to replace the four it has sold to the British India Company.

The Dominion Line

seems to have entirely captured the best class of passenger traffic between Liverpool and Boston, for they have made three sailings out of every four during the present season with the magnificent twin screw-steamships *New England*, *Canada*, and *Derbyshire*. These are far finer and faster than anything else that frequents the Massachusetts port. They have long ago secured the speed record which the Cunard Line had obtained when it ran the *Servia* and *Aurania*—now running as extra New York boats on the route. The *New England* at the end of July beat her own westward record, lowering the time of passage to six days, seven hours, and forty minutes, and on one day doing 440 nautical miles as her run. This is equal to a speed of upwards of 17·8 knots. Against her were running for the premier Atlantic line the *Ultonia*, which, starting two days before her, got in one day after her, and the *Pavonia*. The latter sailed five days later, and was nine and a-half days over the crossing. It would seem that the old *Samaria*, which is still employed in their Mediterranean service, is not the only vessel that is waiting to be disposed of out of the Cunard fleet.

The Allan Line

has now its *Parisian* at work again. Her appearance has been altered by the substitution of a single large funnel for the two with which she was formerly fitted, and her speed has been materially increased by the improvements in her engine and boiler rooms. The line has further been reinforced by the addition of the *Bavarian*—a fine twin screw-steamship of over 10,000 tons gross register, built and engined by Messrs. Denny & Company, of Dumbarton. This vessel arrived at Liverpool from her builders on the 17th August, and started on her maiden trip to the St. Lawrence on the 24th August. This vessel is remarkable from the fact that she is the first instance of the adoption of the twin-screw principle by the Allan Line. It is true that these owners have in their fleet three vessels, the earliest Atlantic steamships so constructed. But they were not built to their requirements, and their possession did not in any way bind the line to the approval of the principle. The *Bavarian*, on the other hand, must be in every way held to embody the ideas of what a mail and passenger ship for the St. Lawrence trade should be in the eyes of those who have by far the longest experience of the trade and who have shown themselves most conservative in their ideas.

The Elder, Dempster Company,

which has now the Canadian mail contract, is running the *Arawa*, once the crack vessel in the New Zealand trade, in its mail service from Bristol *via* Queenstown to Montreal, whilst Messrs. Allan have her sister ship, the *Tainui*, in their mail line.

Dock Extensions

seem to be the general rule in all directions. There is talk of further extensions at Liverpool, and of the removal of the timber trade headquarters from the Canada Dock—displaced thence by dock enlargements—to Wallasey. At Barrow a gigantic graving dock is to be built. Its length will be nearly a thousand feet, and its entrance a hundred feet wide, with a depth on the sill of 30 ft. The entrance to the Ramsden Dock is to be deepened from 24 to 30 ft.; but, as this latter work is to be completed before the graving dock is to be undertaken, it will be some time before the dry dock will be ready to be occupied.

Changes in Shipping and Shipbuilding Concerns.

Not only are vessels themselves being shifted about from one ownership to another, and back again, with a frequency which makes it very difficult to keep in touch with their movements, but the companies themselves are also constantly changing. Quite recently the Sun Shipping Company—whose managers are Messrs. Robert Alexander & Company, of Liverpool—has been absorbed by the Hall Line, which is under the same management. Now the Gulf Line, Limited, has been formed to acquire the businesses of the Greenock Steamship Company, Limited, and of the Gulf Line Association, Limited.

The "Gaspesia."

The prospects of the crew of this unfortunate vessel look a little brighter since last we wrote. The Supreme Court of Newfoundland has reduced the amount payable as salvage to the owners of the steamship *Kite* to 2,500 dols., whilst the vessel herself has been sold by the court for the sum of 27,000 dols. We may fairly hope that out of the proceeds there will be something left for the claims of the men who worked and suffered in her for so many months, and whose claims were so powerfully set forward in the letter of her chief engineer.

The Engineers of the Steamship "Kennett"

have distinguished themselves by a remarkable repairing job. The vessel in question is of about 1,700 tons gross register, and is fitted with triple-expansion engines of 188 N.H P. Having broken her propeller shaft in the Atlantic, an attempt was unsuccessfully made to fit a spare screw which was stowed on board. The failure to carry out this effort only spurred them to fresh exertions. A new propeller was manufactured from plates and doors in the ship, and eventually fitted to the remainder of the shaft. Sixteen days were consumed in the work; but so well was it done that the ship was enabled to traverse a distance of 1,200 miles under her own steam, and thus to make the island of Barbadoes without taking assistance.

The Norddeutscher Lloyd

still goes on increasing its fleet. The *Koln*, one of three sisters for the Baltimore service, has just been launched at Bremerhaven. Now another 10,000-ton twin-screw-steamship is ordered for the New York Line from the firm of J. C. Tecklenborg & Company, of Geestemunde. A paper published some few weeks ago by the company gave the following list of vessels under construction:—

For the New York Line:—Grosser Kurfurst, gross tonnage, 12,500; *Rhein*, 10,000; *Main*, 10,000.

For the Australian Service:—Konig Albrecht, gross tonnage, 10,000; *Prinzess Irene*, 10,000.

For the Baltimore Service:—Koln, gross tonnage, 7,500; *Frankfurt*, 7,500; *Hannover*, 7,500.

For the East Asian Line:—Strassburg, gross tonnage, 5,000; *Wurtzburg*, 5,000.

For the North Sea:—Nixe, gross tonnage, 800.

Eleven vessels in all, comprising 85,800 tons, an average of 7,800 tons per bottom. The aim for the New York express service, of course, is to run it with the four vessels, *Kaiser Wilhelm der Grosse*, *Kaiser Friedrich* (when her builders get her right), *Kaiserin Maria Theresa*, and this *Grosser Kurfurst*.

The *Fulda* may be struck off the list of the fleets. She has been found irreparable after her accident in the Birkenhead Dock. At Bremerhaven she was dismantled and deprived of her engines, and the sheer hulk has now been towed to a German outport for dismemberment. Her sister, the *Werra*, seems no more likely than she ever was to see the port of Paspebiac, for which the Canadian Steamship Company, Limited, had destined them. The purchase was never completed and the *Werra* has been again offered for sale at Liverpool, which she left on the 25th August; but no satisfactory bids were forthcoming.

Canadian Steamship Lines.

The present season has seen the discontinuance, for a time at least, of two Canadian lines. One of these, of course, is the Canadian Steamship Company spoken of above. The other is the Beaver Line Associated Steamers, of which Messrs. D. & C. MacIver were the managers. As mentioned in a recent issue, they lost some time ago the "Lake" boats, which were sold with the name of Beaver Line and the goodwill of the old Canada Shipping Company to Messrs. Elder, Dempster & Company. They, however, were not to be beaten by that. They went on with the *Gallia* and the *Tongariro* under the title which we have quoted. Then the *Gallia* left them, and was replaced by the *Ruapehu*. But she was not long employed. The sailing for the 10th of June was not made, and no further dates have been advertised.

The Kaiser Friedrich."

Since the above was in type it has transpired that she will not run again for the Norddeutscher Lloyd, but will be taken over by the Hamburg-American Line.

CRAWFORD'S PATENT WATERTIGHT BULKHEAD DOOR FOR SHIPS' HOLDS.

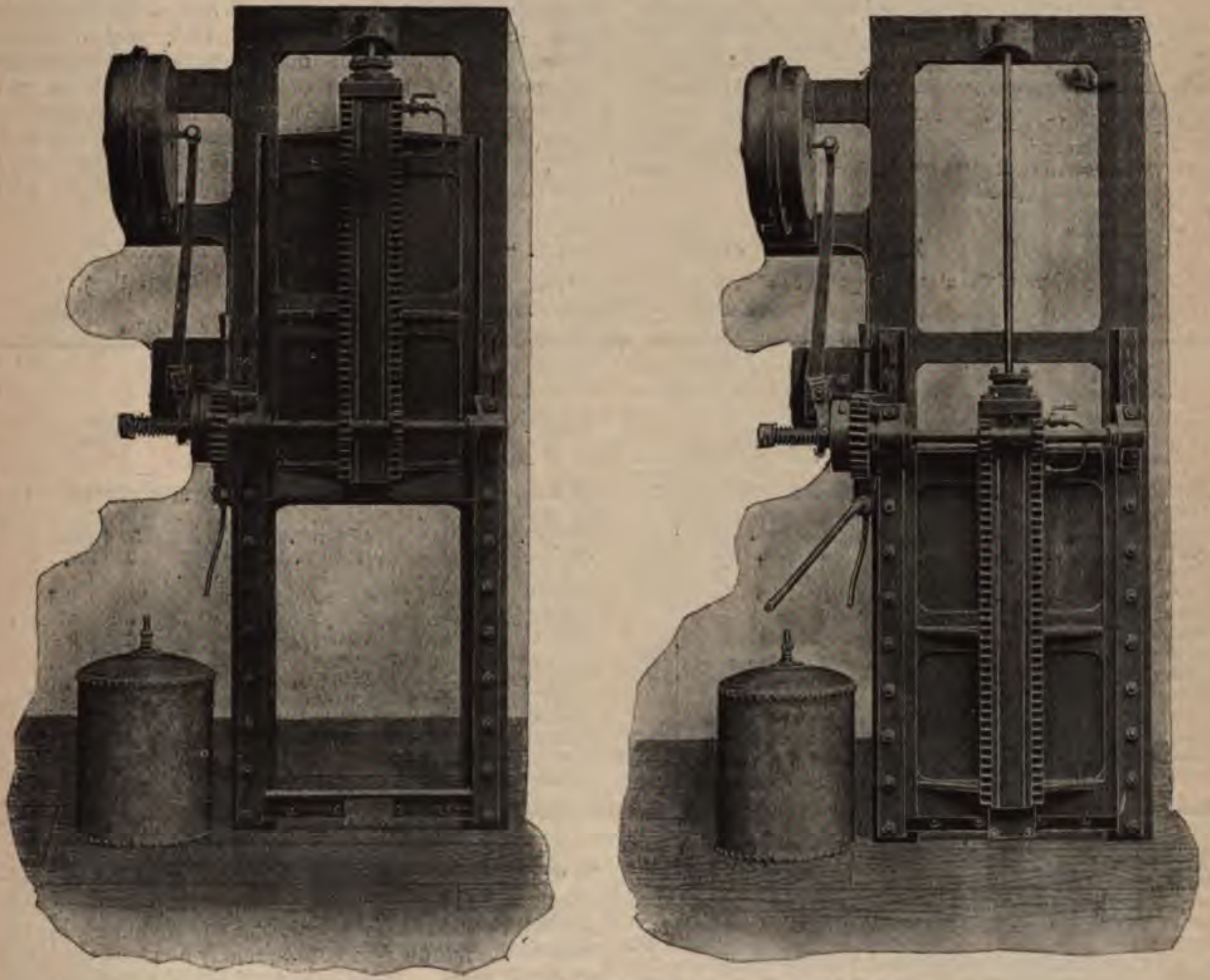
THE accompanying illustrations show the "Crawford" patent automatic watertight bulkhead door for the holds of ships—one of the latest, and probably one of the most promising, of the many inventions of this kind put before the shipbuilding and shipowning worlds within recent years. It is claimed for it that it is automatic in a truer sense than in any door yet invented, in that it requires neither the action of man, electrical or other appliances, to make it effective at the critical moment, the automatic action in its case depending upon the pneumatic force produced, in the special device provided, through the inrush of the sea to a vessel's bilges in the event of an accident to the shell.

The illustrations given show the door in the open and the closed position respectively, and with their aid only a few sentences of description are necessary to convey a clear understanding of its working. Whilst the special feature is its automatic character, the door can, of course, be operated by hand from the deck, or otherwise if desired. First, as to the action of the door, and the gear in connection, when automatically operated on. Assuming the vessel's shell to have been pierced, either through striking on rocks or from other cause, the inrush of water into the bilges of the vessel enters the galvanised iron air-vessel, or chamber, there situate (shown to the left of our illustrations). The compression of air in this chamber caused by the rising water is carried up a small copper pipe leading to one side of an elastic metallic diaphragm, shown alongside the upper framework of the door. From the centre of this diaphragm, on its opposite side, projects a pin, attached to a vertical lever, which, at its lower end, actuates a clutch, throwing in or out of gear the shaft and gear by which the door is raised. The air-compression, acting on the diaphragm-pin and lever, withdraws the clutch, and the door is free to fall by its own weight.

The diaphragm is only about 15 in. outside diameter, and is extremely sensitive, as may be judged from the fact that it operates, and the door falls, when from 6 in. to 10 in. of water enters the air-chamber. The air-chamber itself is only about 12 in. in diameter, and, of course, can be made in any shape or form to suit each individual requirement.

In order, however, to minimise the risk of life and limb being endangered, as they so often are by the sudden sharp fall of a heavy door, and also with a view to giving the crew in the holed compartment of the vessel a better opportunity of effecting their escape, a retarded motion is imparted to the door for the greater part of the period of its fall. This is effected as follows:—To the door is attached a cylinder filled with oil, fitted with stationary piston-rod and piston, secured at its upper end to the bulkhead, the piston having a hole bored through the same, the size of the hole regulating the speed at which the door falls. A by-pass pipe, which may be seen fitted at the top of the cylinder (or an enlargement of the diameter of cylinder), permits of the easier passage of the oil to the other side of the piston, thus allowing the door to fall *sharply* into its closed position when about six inches from the bottom.

Whilst the door is being raised by means of a portable handle (or wheel), the powerful long spiral spring, seen to the left of the clutch, immediately presses the latter into position, thereby putting into action the horizontal shaft, thus raising the door by means of the rachets (seen on each side of the cylinder, but which have in later-made doors been put on each side-frame of the door as being a better arrangement). The usual deck connections, as has been stated, are fitted. The automatic arrangement here described can be adapted to existing doors.



Crawford's Patent Watertight Bulkhead Door for Ships' Holds.

We understand that several large liners at present under construction are having "Crawford's" patent doors fitted, and that they are likely to be freely specified in future by some of our largest steamship companies.

A full-sized door has been shown in the Glasgow Royal Exchange and elsewhere, and one can be seen working on application to Messrs. William Christie & Co., 70, Wellington Street, Glasgow, who are the sole agents for the sale of the Crawford patent door.

Messrs. W. Thacker & Co. will issue in the early autumn "The Imperial Russian Navy," which is the title of a forthcoming book of reference by the well-known naval author and artist, Fred T. Jane, and will be issued simultaneously in England and America. Mr. Jane, who has recently returned from St. Petersburg, where he was the guest of the Grand Duke Alexander Michaelovitch, a captain in the Russian Navy, was given exceptional facilities for visiting the Imperial dockyards and Arsenals. The book, which will deal with the past history of the Russian Navy, its present position and its future, will be copiously illustrated by the author. The book will contain: Chronological history of the Russian Navy from the days of Rurik's attack on Constantinople, A.D. 865 to the present day, with photographs of all modern ships, and full descriptions; the Russian dockyards and shipbuilding programme; the personnel, armament, equipment, and drill of the fleet; and a variety of other interesting naval matters.

We have received for our inspection a series of pictorial post-cards of typical British war ships from original pictures executed specially for this series by Mr. Fred. T. Jane the celebrated naval artist. These cards are reproductions in no fewer than 12 colours; they are considered the finest examples of chromo lithography in this class of work yet produced, and being retailed at the extremely low price of 1s. per series of 12 cards ought to command a large sale amongst both naval and marine engineers, and others who are engaged in maritime pursuits. They are published by Mr. A. Ritchie Leask, 95, Minories, London, E.

WESTERN AUSTRALIAN COAL PROSPECTS.

AN important report has been received from Rear-Admiral Pearson, through the Governor of Western Australia, Sir Gerard Smith, K.C.M.G., by the Agent-General, the Hon. E. H. Wilkinson, to the effect that he has tried 100 tons of Collie coal on board H.M.S. *Royal Arthur*, at the request of the Government of the colony, and compared it with the coals of Westport (N.Z.), Metropolitan (N.S.W.), and Lithgow (N.S.W.). He says, "the Collie coal is a rapid-burning, wood-like coal requiring a good air supply for its combustion. If the air supply is checked, it deadens very rapidly and takes some time to rekindle. For this reason, it is unsuitable when the speed has to be frequently altered; but for steady speed steam can be more easily maintained. Its special advantages are a practically entire absence of smoke and a very small percentage of ash, the former being a great contrast to all the Australian and New Zealand coals that have been used, which give off very large quantities of dense smoke."

A very favourable opinion of this coal was given last year by the late Sir Frederick C. McCoy, of the University of Melbourne, who described it as "a true coal and of great commercial value."

RESULTS OF TRIALS ON H.M.S. "ROYAL ARTHUR."

Comparison of the steaming qualities of Westport (N.Z.), Metropolitan, Lithgow, and Collie coals (Australian).

Duration of trials:—21 hours.

	WESTPORT, N.Z.	AUSTRALIAN.		
		Metropolitan, N.S.W.	Lithgow, N.S.W.	Collie, W.A.
Dates of trials	11th June, 1898.	3rd & 4th May, 1898.	13th & 14th July, 1898.	24th & 25th June, 1899.
Average coal used in making the distance logged per hour ..	33·5 cwt.	43·3 cwt.	45·5 cwt.	58·4 cwt.
Steam pressure	125 lbs.	125 lbs.	125 lbs.	120 lbs.
Revolutions per minute	52	55	55	58
Force of wind	Bow 4·5	Bow 3	Bow and ahead 2	Astern 2·5
State of sea	Slight	Slight	Smooth	Slight to moderate
Average I.H.P.	1819 9	1874·3	2042·87	1948·3
Average coal used per I.H.P. per hour	2·07 lbs.	2·43 lbs.	2·49 lbs.	3·35 lbs.
Percentage of ash and clinker ..	5·85	21·3	24·72	6·7
Rate of combustion	Moderately quick.	Quick	Rapid	Very rapid
Emission of smoke	Much dense black	Much dense grey	Considerable dense black	Nil
Grate surface in use	356·4 square feet	456·8 square feet.	456·8 square feet	456·8 square feet.
State of ship's bottom	Foul	Foul	Very foul	Clean

Professor Wyndham Dunstan, F.R.S., Director of the Scientific and Technical Department of the Imperial Institute, has just made a very complete charcoal and technical examination of this coal, conducted in the Scientific Department of the Imperial Institute. Professor Dunstan reports that this coal, the principal sample of which was procured from the West Australian Wallsend Colliery (formerly the Government mine), the Collie, "is likely to be of very considerable value. It burns somewhat quickly, giving out much heat and leaving a small percentage of ash." He further says that "although Collie coal cannot be put into the first class, there can be no doubt that it will prove to be a very valuable fuel for the colony of Western Australia, where coal is scarce and where wood is largely depended on for fuel. As a steam-raiser it is greatly to be preferred to wood, and also to many other coals of better composition which produce much smoke when burnt. It will no doubt be employed extensively as a domestic fuel, since it quickly makes a hot and non-smoking fire." Professor Dunstan also suggests that the coal may be employed "in certain metallurgical operations, in which coke is not necessary," and recommends that trials should be made in the colony to determine its value as a gas-producer.

A large sample of Collie coal is now on exhibition in the Ducal Hall, Earl's Court.

COWPER-COLES MAGNETIC SCALE COLLECTOR.

THE removal of mill scale from forgings and plates has always been a matter of considerable difficulty, the scale in many cases being 1-32 inch in thickness. The usual practice is to place the iron in a solution containing one part of hydrochloric or sulphuric acid to 10 parts of water for from half-an-hour to 24 hours. The Admiralty specify that all steel steam pipes, boiler and collector tubes, and all plates for boilers are to be pickled in a solution consisting of 19 parts of water and one of hydrochloric acid until the black oxide and scale formed during the process of manufacture is completely removed. The amount of acid consumed in the pickling of close annealed sheets, such as are used for roofing purposes, varies from three cwt. to seven cwt. of muriatic acid per ton of sheets; if sulphuric acid is used, considerably less is required. Muriatic acid is used in preference to sulphuric acid by a large number of manufacturers, because it is cheaper bulk for bulk, and also because it acts less quickly on the skin of the metal, and consequently has less tendency to eat it away. In Worcestershire alone about one thousand carboys of acid, corresponding to some 27,000 gallons of waste pickle, have to be got rid of weekly. During the process of pickling, large quantities of magnetic oxide and scale become detached from the plates, which, if allowed to remain in the pickle to be further acted on by the acid, form a serious source of loss. The present invention has for its object the prevention or diminution of this loss, which is accomplished by means of the apparatus shown in Fig. 1, which gives a sectional elevation of a lead-lined pickling tank, with a scale collector placed in position. The scale collector is placed in any convenient position in the tank, and connected by means of terminals A A to a depositing or

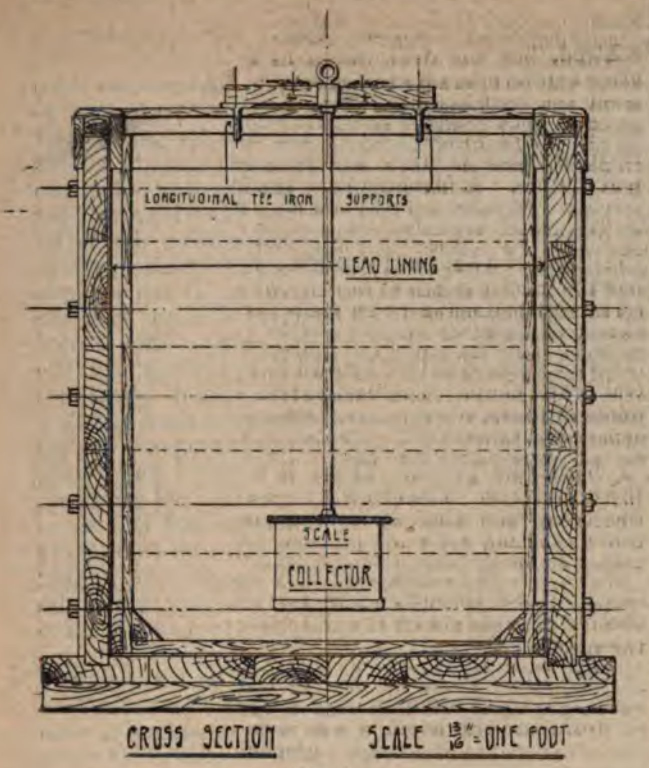

LONGITUDINAL TEE IRON SUPPORTS
LEAD LINING
SCALE COLLECTOR
CROSS SECTION
SCALE $\frac{13}{16}$" = ONE FOOT

Fig. 1.

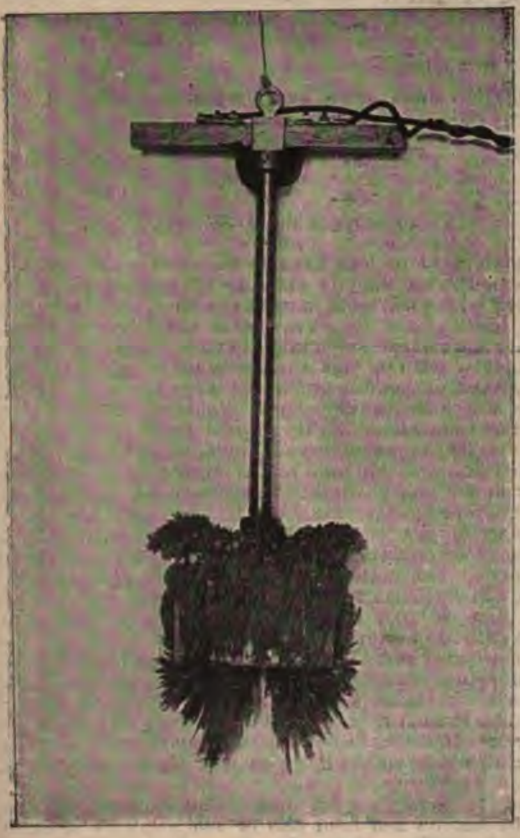


Fig. 2.

electric lighting dynamo, the current required to work it being about ten amperes when an E.M.F. of six volts is employed. In the case of large baths two or more collectors can be employed, or only one may be used, this being moved about to different parts of the bath, at suitable intervals. From time to time the scale collector is taken out, and the adhering scale removed, either by breaking the circuit, or by means of a suitable brush or scraper. Fig. 2 is taken from a photograph of the apparatus after it has been dipped in iron filings; it will be noticed that the electro-magnet has consequent poles—this method of connecting up has been adopted with the object of distributing the field as much as possible.

The apparatus can be attached without difficulty to any ordinary lead-lined pickling tank, and it collects the magnetic oxide or scale almost as soon as it leaves the plate, instead of allowing it to remain in the solution, thus a considerable saving of acid is effected.

NEW YO
PUBLIC LIBRA
LENOX AND
FOUNDATIONS.

THE BLACKMAN VENTILATING COMPANY.

AIR is moved by artificial means for various purposes. It is required for ventilation, for bringing a new atmosphere in place of the old and continually changing it; it is required for combustion at a greater or less rate; it is required for cupola furnaces and for working machinery by the compressed air system. Sometimes the air is made to move by a fan, and sometimes by an engine or blower. Should a high pressure be required a blower or engine must be used, should the pressure be less a fan may be used. When great volumes of air have to be set in motion, a high pressure is not so necessary, and a fan which can take through it great volumes of air at low pressure is wanted. When the draught is high, when it is required to produce a very rapid motion of the air, another kind of fan requires to be used. When the air has to be used at high pressure for engines and other purposes, blowers or direct-acting pumps must be used. One of the most successful fans for setting in motion large quantities of air, that is, for changing the atmosphere is the Blackman fan. When foul air is to be cleared out or the vitiated air of a room to be removed and fresh air brought in, or hot air is to be sent through a room for warming it, then the Blackman fan is got to do the work. It is used in all sorts of places, but we are simply interested in it as a means of ventilating the ship. In looking down the table giving the quantities of air set in motion by any particular-sized fan one is astonished at the enormous quantities. A small fan of 14 in. diameter and 1 square ft. area, making 1,000 to 1,500 revolutions per minute and using $\frac{1}{8}$ to $\frac{1}{4}$ H.P., will cause to go through it 1,000 to 1,500 cubic ft. of air per minute; one 60 in. diameter and 19·6 square ft. area, and using from 1½ to 3½ H.P., will cause to move through it from 21,000 to 45,000 cubic ft. of air; and the largest size in the list of fans, 120 in. diameter and of 78·4 square ft. area, and making 120 to 220 revolutions per minute, will cause to move through it 82,000 to 180,000 cubic ft. per minute. But a curious thing was seen whilst we were being conducted over the works of the Blackman Ventilating Co. in the Holloway Road. One of the shops on the upper floor was ventilated by means of these fans. There were two fans, one at each window of one end of the building, and another fan at a window in the side. Pressure was not necessary, or the spaces between the fans and the sides of the window would have been filled up. These spaces were left as they were. At the ends of the building, however, the fans were set on the floor, the bay of the window being above them. The result was that a draught was induced through the window by the air in movement through the fan. The action of the fan set in the window in the side of the building was just the same. The fan was simply placed in the window, and the effect of the sides not being filled up was not to reduce the effect of the fan, but to increase it. It is said that shoemaker's children are worst shod. This is not the principle held at the works of the Blackman Ventilating Co. These are well ventilated.

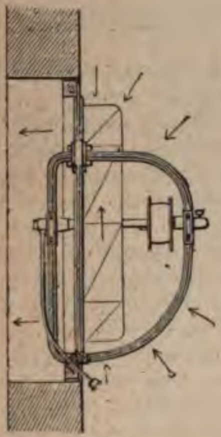


FIG. 1.

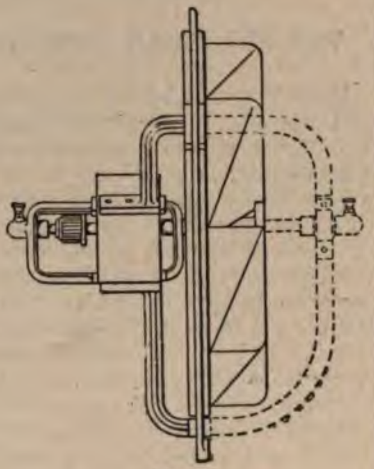


FIG. 2.

The motive power for the fans may be almost any power, but the electric motor, whenever it can be used, appears to be popular. It must necessarily be very economical, since there is no friction consumed at the bearings by the pull of the belt. The first shop we entered, and the first floor above, were devoted to the making and fitting of electric fans. One had been fitted, and was standing on the floor on its edge. It was connected with a switch and resistance-board, and was extemporised by the workmen for producing good ventilation of the shop during the hot season. The fan was run at a fast rate to show what it could do. It could produce a draught equal to $\frac{3}{4}$ in. of water when running at 600 revolutions per minute.

The shops had just been extended. All they had, a short time ago, was the present machine-tool shop; but the extensions are quite equal in area to the old works. In the new shops there have just been laid down a 35-H.P. gas-engine and four dynamos. One dynamo is alternating, and direct for testing purposes. In the centre of the shop space are the stores, with doors at each end, so that stores can be conveniently taken away. At one end of the machine-shop the workmen are making wheels. Everything is made to gauge. Castings are bored to gauge on a boring machine with four heads. The holes are not centred, but the drill works in a template, and no error can be made by the workman. At another place were the field-magnets of motors, made of steel, to work at 500 volts. Every fan has its pulley, and there are thus as many key-ways as there are pulleys and motors. A machine cuts the key-way out in one stroke. The cutting tool is a long bar with a number of cutters on its under edge, each getting deeper by the depth of a cut until the last one is reached, which has the proper depth of the key-way. It can cut from 60 to 100 key-ways in an hour, all of them with the proper taper to be given to the cottar. The works' main shafting is driven by a 16-H.P. gas-engine at the end of the shop. The vanes of the fans are sometimes made of brass, sometimes of manganese steel, and they are stamped out to shape and cut out with a press worked by hydraulic power. There is a stove for drying the armatures. The electric stores are well arranged. Shelves of the sections for different-sized commutators have been fixed up, and the soft iron core sheets when fixed on the spindle only require the milling machine tool through them for the spaces, and the turning of a thin cut off the periphery to reduce them to the proper size.

After this description it will not be surprising to learn that there are now over 40,000 Blackman fans at work, and the average size is so considerable that they are capable of moving 1,000,000 tons of air every hour.

The illustration (Fig. 1) shows the Blackman fan as usually supplied. The position of pulley is varied to suit circumstances. Fig. 2 shows a fan combined with electric motor, shown on its discharge side. The motor is placed on the feed side whenever required. The dotted lines show arms which are used in larger sizes of fans.

MR. BENJAMIN MARTELL.

IT is our duty in this issue to chronicle an event in connection with Lloyd's Register of British and Foreign Shipping which we feel sure will be received with interest by a large number of our readers in view of the wide and extensive celebrity and eminence attained by the gentleman, Mr. Benjamin Martell, who for the past twenty-six years has occupied the responsible and onerous position of chief surveyor to this important and extensive institution. We refer to the fact that on August 3rd the committee of Lloyd's Register accepted with infinite regret the resignation of their chief surveyor. We feel sure that this announcement will produce a genuine feeling of sorrow on the one hand that this gentleman has thought it desirable to sever his connection with an institution which he has so largely contributed to foster, maintain, uphold, and advance by the scientific construction of shipping; whilst on the other hand it is a matter of gladness and good feeling to think that Mr. Martell has retired with a prospect of many years before him to enjoy the leisure which his active and well directed life has so amply entitled him to.

It is no empty statement when we say that Mr. Martell has been for many years a very conspicuous figure in the shipping world, and the nature and general scope of the work carried out by him in such a masterful and thorough manner has been the means of creating for him a large number of friends and admirers in the shipbuilding, as well as the shipping and scientific, world.

When one bears in mind that during the twenty-six years that Mr. Martell has been one of the principal advisers of Lloyd's Committee, some of the most radical and far-reaching changes have been made in the matter of shipbuilding, an industry which is perhaps one of the, if not the, greatest in our empire, one cannot help being struck by the diversity of conditions and the wide area of thought that must have been passed through by Mr. Martell during this extensive term of service, involving great responsibilities. It must be remembered that in carrying out the duties of his office, very serious problems have had to be settled upon a safe and reliable basis, at the same time not neglecting to take advantage of any improvement in the arts and sciences which might fairly be expected to improve the efficiency, utility, and safety of a ship. We may remind our readers that since 1873, when Mr. Martell first took up the chief surveyorship, we have passed through the most marvellous period of advancement in shipbuilding yet known viz., the change from wood to iron, then iron to steel, the transition from sail to steam, from small ships to gigantic leviathans, from the compound to the triple and quadruple expansion engine, and from 7-knot vessels to magnificent liners of over 20 knots speed. It must not be forgotten also that in many cases every step forward made was one made substantially in the dark, there being practically no results from past practice to prove or bear out the correctness or otherwise of the conditions which were brought into play under the new circumstances.

Besides the excellent work which Mr. Martell did in reference to the use of mild steel for shipbuilding purposes, he took a prominent and influential part in the discussion of the important question of the load line, and the results of his first investigations were submitted to the Institute of Naval Architects in a paper read by him in 1874, and it is a fact worthy of note that the data given in that paper substantially constitute the basis of the freeboard tables since legalised by Parliament, and now applied to British mercantile shipping. In this connection no doubt his work was materially assisted by his friendship with the late Sir Thomas Gray of the Board of Trade.

Like many of his colleagues Mr. Martell received his early training in the Royal Dockyards, and first became a Lloyd's surveyor in 1856, when he was appointed to the post of Sunderland, where he remained three years. He proceeded successively to Greenock, Southampton, and again to Sunderland, and in 1869 he was promoted to the chief position of the Newcastle office, whence in 1873 he was promoted to the post of chief surveyor to the society. It will thus be seen that before attaining the high position which he is now vacating, Mr. Martell had a very varied and valuable experience, which, no doubt, has served him exceedingly well during his many years of responsible work.

In entering upon his duties of chief surveyor, Mr. Martell had to follow, in the person of the late Mr. Waymouth his predecessor, a gentleman of eminent standing, great experience, and marked ability, which without doubt must have tended to increase the responsibilities and difficulties in taking up the reins of office. Quite apart from his technical ability, Mr. Martell owes his success mainly to the sound judgment and great ability displayed by him in dealing with the conflicting interests which so often arise in the building of a ship as between the owners and shipbuilders, and that he has been successful is evidenced by the great respect and admiration so generally felt for him by those who have been able to appreciate his ability.

It is not only in his official capacity at Lloyd's, or on the various committees upon which he has served, that Mr. Martell has expended his energy; but as a member of council and vice-president of the Institution of Naval Architects he has been most assiduous in promoting the welfare of this society, and his presence at most of the meetings was the rule rather than the exception.

It has been our pleasure and privilege to know Mr. Martell intimately for many years, and we take this opportunity of saying that we sincerely hope that he may have many years of health and happiness to enjoy his well-earned retirement and rest, a consummation which his earnest and useful work so richly entitles him to.

Japanese Institution of Naval Architects.—The second annual meeting of the Japanese Institute of Naval Architects took place at Tokyo on July 15th, when the following papers were read:—"About Dry Docks in Japan," by Mr. Tsunekawa; "On S. Tsutsumy's Patent Composition to Prevent Leakage of Marine Boilers," by Mr. Iwata; "About Shipbuilding in Shanghai," by Prof. Miyoshi; "American Navy, Past and Present" (illustrated by about 200 magic-lantern pictures), by Captain-Constructor Sakurai.

RADIATING, DRILLING, BORING, TAPPING AND MILLING MACHINE.

THE lessons that the Americans have been giving our tool-makers for some years past are being rapidly taken to heart, and there are plenty of examples of machines now put upon the market as evidence of this fact. The old idea of having a machine which can only do one particular class of work is quickly vanishing, and we have the pleasure to describe and illustrate a very ingenious tool made by Messrs. Neville Bros., of 14, Water Street, Liverpool, which is capable of drilling, boring, tapping, and milling, with a large variety of movement and adjustment of the operating tool.

The four illustrations which are adjoined are produced from photographs of the machine in various positions, and are so clear as to render a lengthy description unnecessary, as they show at a glance the mechanism and utility of the machine. The special feature of the machine is the radial arm, which can be revolved in a complete circle by means of the junction box containing the gear wheels, through which the motion is conveyed to the tool, and enabling it to be placed vertically, horizontally, or at any angle to the work on the table, as shown in Figs. 1, 2, and 3 respectively; or when the table is swung out of the way, to work on the base plate of the machine, as shown in Fig. 4. Thus one of these machines will do the work of a vertical, a radial, and horizontal drilling, boring, tapping, and milling machine.

The frame is of box pattern, with planed slides for the saddle carrying the table. The table is rotary, and has a slide with ⊥ slots, so that any part of the work can be quickly brought under or opposite to the tool. The table is raised and lowered automatically by means of bevel wheels on the counter shaft; these parts, however, are not shown very clearly by the illustrations. The table is hinged, and can be swung completely out of the way of work placed on the base plate, as before described in reference to Fig. 4.

The driving motion is double-geared, and all the wheels have dust-proof casings. The drill-spindle is of steel, and has self-acting and hand-variable feed motion. The tool is made in two sizes, the latter of which has a drill-spindle of $2\frac{3}{16}$ in. diameter, having a depth of feed of $11\frac{3}{4}$ in. It will admit of work 3 ft. 11 in. in diameter. The length of the table is 26 in., and its width 20 in.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at Home and Abroad.)

The Manœuvres and After.

THE majority of the vessels which took part in the Naval Manœuvres held in the early part of last month have now gone out of commission, and are once more in the Fleet Reserve. As was expected, a few have been commissioned for service on foreign stations. It is to be regretted that the fog prevented the "A" fleet from discovering the convoy, and that Admiral Domvile had such an easy victory, as otherwise some very valuable lessons would have been learnt; whereas now one can only guess what might have happened, and reason on that. Admiral Domvile's aim was, of course, to get in touch with the convoy as quickly as possible, and he made his dispositions with this end in view. Soon after he left Milford he found that if he

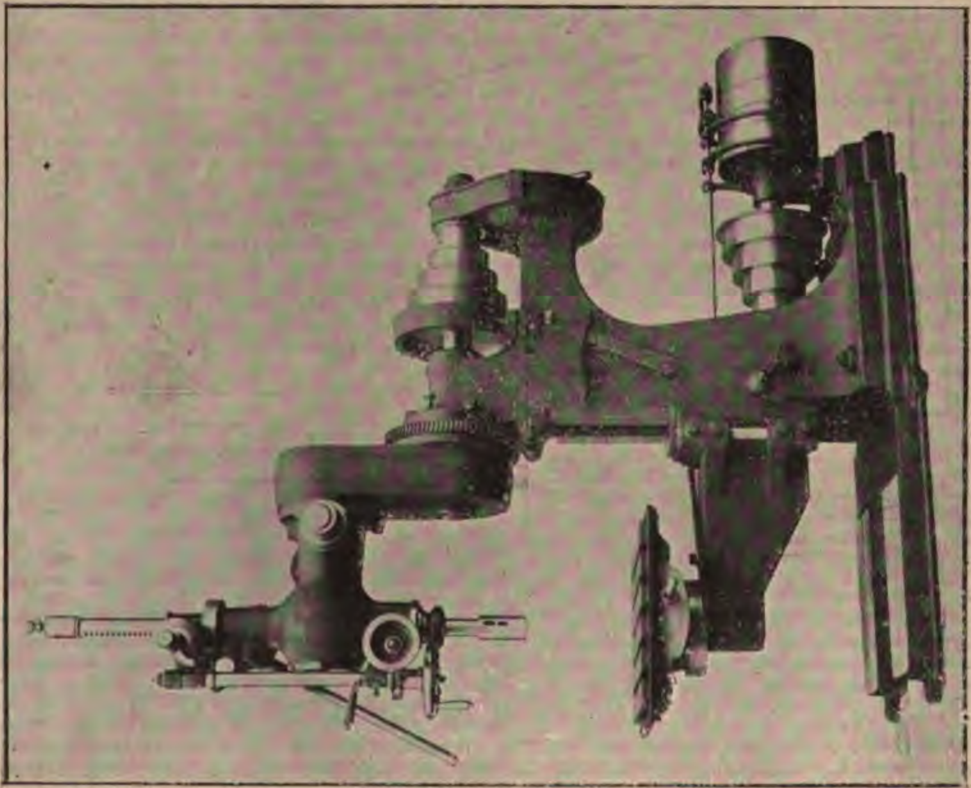


Fig. 1.

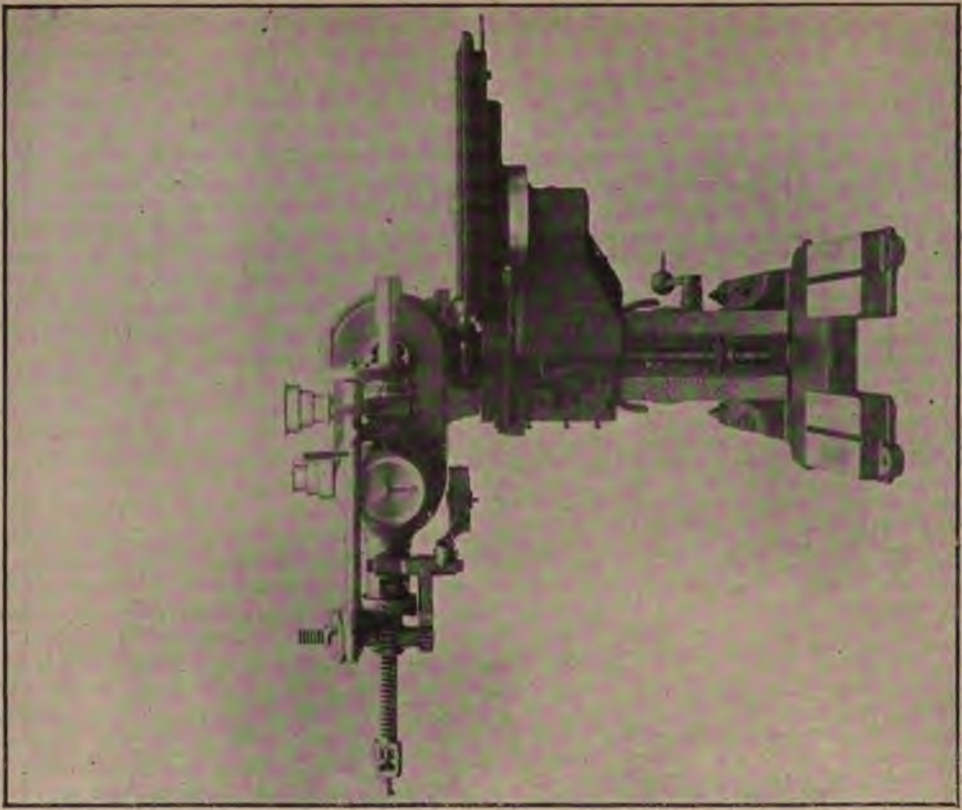


Fig. 2.

Radiating, Drilling, Boring, Tapping and Milling Machine.

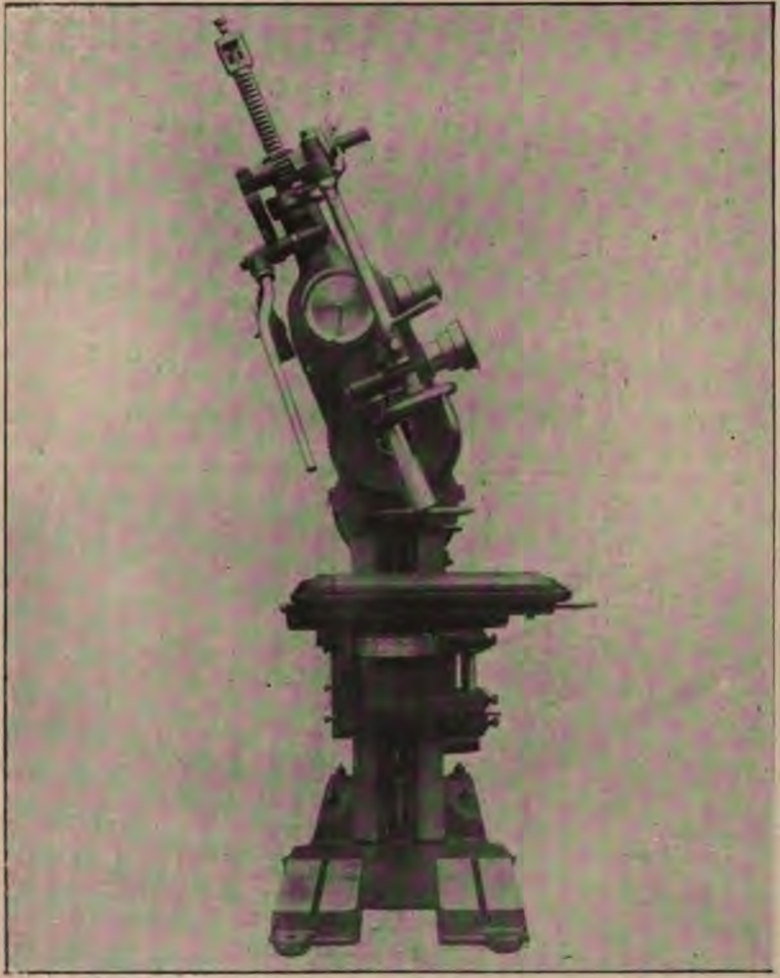


FIG. 3.

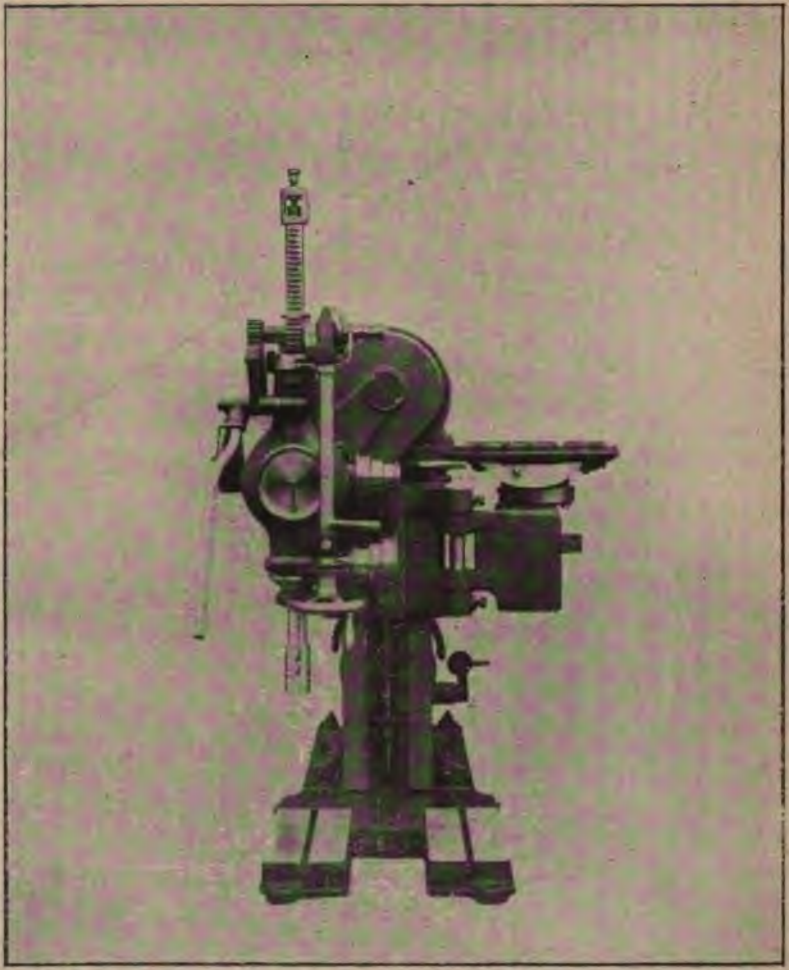


FIG. 4.

RADIATING, DRILLING, BORING, TAPPING AND MILLING MACHINE.

kept the *Thunderer* company his fleet could only steam at 10 knots, and she was therefore dropped. He then proceeded at 12 knots, and a little later the cruisers he had sent out to locate the convoy sent back word by the means of the Marconi wireless telegraphy that the convoy was in their charge, and that they were steaming back to the squadron. He reached Milford with his battle squadron without any further incident. The cruisers sent out by Admiral Domvile managed to capture a couple of the enemy's cruisers, the *Pactolus* and *Furious*.

Results of the Operations.

From the first it could be seen that Admiral Rawson did not have a very good chance of finding the convoy, even if there had been no fog, and he had been supplied with the Marconi system of wireless telegraphy. The latter certainly did not help "B" fleet to score over its rival, but the employment of this means of communication would have given Admiral Rawson a better chance, and the thick weather would not have hindered him so much as it did. Both admirals played the game as they ought to have done, but did not have an equal chance of victory. Admiral Rawson's start of 19 hours was not sufficient, yet if he had risked a little more and had sent cruisers straight to the spot indicated by the correspondents of the *Times* and other papers, he would have been successful in finding his enemy, for, as it turned out, the correspondents were only a few miles out in their calculations. Very little fresh light as to the value of cruisers as scouts has been shed by the operations. The only genuine success, as a matter of fact, is that achieved by the Marconi system of wireless telegraphy. It was demonstrated that messages could be sent over a space of 30 miles. The only difficulty was to decide whether a vessel fitted with a receiver, and within a radius of 20 or 30 miles of the *Europa* or *Juno* could have taken in messages which passed between these two latter. If Admiral Rawson had had some of his cruisers fitted with Marconi's system of wireless telegraphy, this would have been settled, although there is little doubt that it would have been in the affirmative provided the vessel had been fitted with a sympathetic receiver. However, it is reported that Signor Marconi has now solved this question. Altogether it cannot be said that the Naval Manœuvres of 1899 have fulfilled their great expectations.

Coaling at Sea.

The special correspondents and naval experts of various daily papers have often held forth in the columns of the journals to which they are attached in favour of having special colliers built to accompany a fleet to sea in order that that fleet need not be under the necessity of having at any time to put into port to obtain coal. On the face of it, the scheme seems to be a good one, although there are points in it which need consideration. The colliers accompanying a fleet must first and foremost be able to steam at the same speed as the fastest battleship in it, and nearly all the colliers should be built on a uniform plan. At the present time there are very few colliers alike in build, and this causes grumbling and delay, the openings through which the coal is delivered being seldom found in corresponding places. In a letter to one of the daily papers, Commander W. L. Down suggests that all colliers employed by the Admiralty should be built to a certain plan to satisfy the requirements of the Navy. He thinks that the construction of two classes of colliers, differing merely in size, would meet our present wants. Each class should be constructed on uniform lines, so that the length of the ship and the position of holds and transporters would be known when once it was ascertained to which class a coming collier belonged. If this were the case, all preparations for coaling a ship at sea could be made before a collier came alongside. Commander Down is sanguine that if a design for such vessels were prepared at Whitehall it would be adopted by the large coaling firms.

Portsmouth Dockyard.

The Naval Manœuvres over, the majority of vessels sent out from this yard are once more out of commission, and demobilisation has been the order of the day. Many of the cruisers fitted with water-tube boilers that have returned to this port report that they suffered from loss of water, probably due to the leaky joints or defects in the evaporators. The only ship which has sustained any damage during the operations was the *Chamois*, which should by this time be out of dockyard hands. The usual examination of ships and buildings took place, but the work of the new battleship *London* probably attracted the most attention. It is said that the Lady Mayoress of London will perform the christening ceremony, and that the Lord Mayor and many other civic officials will attend at the launch. The news that the new president of the dockyard was to be Rear-Admiral Pelham Aldrich was received with a good deal of satisfaction. Admiral Pelham Aldrich's last command at this yard was as captain of the surveying ship *Research*. The *Andromeda* is to be commissioned on the 5th of this month for the Mediterranean Station. The *Sheldrake* has just gone out of commission after having completed her experimental trials with the Babcock & Wilcox boilers, and the gunboat *Seagull* was to have been commissioned two days ago for a series of trials with the Niclausse boiler. A brilliant example of heroism has been published in connection with the disaster on the *Bullfinch*. The story goes that a man named Dennis, employed at the port engine, rushed to the starboard engine, and stopped the machinery immediately after the accident, when pieces of machinery were flying about in a cauldron of deadly steam. Although he succeeded in stopping the engine, he perished in the attempt, whereas had he thrown himself down on his hands and knees on the port side he would probably have been living to-day. The annual inspection by the Lords of the Admiralty took place three weeks ago.

The French Navy.

Amid the din caused by our own Naval Manœuvres, very little notice has been taken of the manœuvres carried out in the Mediterranean by our friends across the Channel. The men of the Naval Reserve mobilised were given a month's training before they were disbanded, and the instruction given during this period has been of the best, judging from the programme of work. One of the most important operations was that carried out by Rear-Admiral Escande, which lasted over five days. With his division of guardships he anchored at night with all lights out in a suitable spot on the coast between La Ciotat on the west, and St. Tropez on the east of Toulon, and there awaited an expected attack by torpedo boats. Elaborate preparations were made to resist this attack, but it was one of the rules that searchlights were not to be used unless an attack was pressed home. One flotilla of torpedo boats proceeded from Corsica and the other from Toulon, meeting at Tamavis Bay, and leaving there in the evening to search the coast. Creeping along the shore near Lavandon Bay to the east of Cape Benat, the flotilla from Corsica discovered Admiral Escande's squadron lying in the bay, and at once attacked. The result, however, appears to have been that no warships were struck by torpedo boats, but that some of the boats were supposed to have been sunk by quick-firing guns. The main objection raised against the new regulations setting forth the authority and responsibility of the chief of the French Naval General Staff is that they are based upon the duties of our own First Sea Lord. Rear-Admiral Caillard, chief of the General Staff, will in future be immediately responsible for the arming and mobilising of the French Navy, and the Naval General Staff, and Central Naval Administration are to be directly under his command. He will select officers for the various ships and stations, and submit their names for approval to the Minister of Marine, and will also deal with matters appertaining to the promotion of officers and the appoinments for shore service. He will also generally act as adviser to the Minister of Marine. Following on the launch of the *Suffren* at Brest, 190 days from the time of laying her keel, comes the launch of the battleship *Henri IV*.

Warships in Collision.

Two rather serious collisions have occurred within the last few weeks, for which the fog, which did so much towards spoiling the interest at first taken in the Naval Manœuvres, appears to have been responsible. One of these collisions only was attended with loss of life. The *Sanspareil*, flying the flag of Rear-Admiral Aldrich, came into collision off the Lizard with the three-masted iron schooner *East Lothian*, vessel of about 1,500 tons net register, bound from Nantes to Cardiff with ballast. The *Sanspareil* struck the *East Lothian* near the break of her poop, causing her to founder in a few minutes. All on board the merchantman, with the exception of three men, clambered on board the battleship. These three men fell into the water, and, although the man-of-war's boat picked up two in time, the third one was drowned. The other accident was the collision which occurred between the despatch vessel *Surprise* and the collier *Netley Abbey*, off St Alban's Head. The collier is an iron vessel of over 1,000 tons register, and was loaded with coals for the Russian Navy, and bound for Cronstadt. Owing to the thickness of the fog the two vessels only became visible to each other when close together, and were, at the time of the collision, proceeding in opposite directions. The collier was practically drifting, when the *Surprise*, steaming at eight knots, ran into her. Some two or three feet of the bows of the despatch vessel were for some time wedged in the beams of the *Netley Abbey*, and the shock was so great that the whole of the framework of the hull of the *Surprise* under water is said to have been affected. Directly it was seen that the collier would have to be abandoned, the crew climbed on board the *Surprise*, which then went at full speed astern and tore herself free, the collier sinking 20 minutes later. Pumps and collision-mats had to be brought into use to bring the *Surprise* into harbour. The result of the court-martial held subsequently was that the officers of the *Surprise* were practically exonerated from blame.

Devonport Dockyard.

The chief event at this yard last month was the two days' visit paid by My Lords of the Admiralty. Mr. Goschen allowed very little to escape his observation, and although his manner does not give one the idea that he is very energetic, yet he stood the fatigue of inspecting each establishment well. Their Lordships expressed satisfaction with the progress made in the various ships under construction. The *Bulwark* has now had nearly 5,000 tons built into her, which is a slightly better average than that attained by either the *Ocean* or *Implacable*. She will be launched on the 20th of October next. The chief trouble in connection with the completion of the *Implicable* and the building of the *Ocean* is the non-delivery of plating, but it is hoped that this difficulty will be overcome before long. Of the ships refitting here the *Edgar*, when completed, is to be used in taking out reliefs to the Australian station, a duty which she performed previously to the satisfaction of all concerned. During the whole of the time that she served recently as a transport cruiser no serious difficulty of any kind was developed in her machinery. The court of inquiry into the disappearance of the 11,000 gallons of olive oil from the storekeeper's department of this yard has been adjourned until returns can be made of the correct amount of oil contained in each vat, as it is stated that in some cases the vats contain more oil than their indicators record, and considering that there 13 vats, each capable of containing 25,000 gallons of oil, there is a probability that in this way the disappearance will be accounted for. Berthing accommodation for 470 officers and men is to be provided on the new second-class cruiser *Hermes*, the largest crew ever carried by a second-class cruiser.

The German Naval Manœuvres.

Nowadays every country possessing a navy, or part of one, goes in for manœuvres, and therefore Germany was obliged to allow her squadrons to face each other in mimic warfare. The manœuvres proper have not yet commenced, but from the 5th inst. to the 15th, a series of offensive and defensive operations will be carried out in the North Sea. The two squadrons commenced tactical exercises in the Baltic on the 21st ult., and finished on the 25th. The first consists of the *Kurfurst Friedrich Wilhelm*, *Brandenburg*, *Weissenburg* and *Worth*, and the *Baden*, *Baiern*, and *Sachsen*, and the second squadron of the armour-clads *Hildebrand*, *Frithjof*, *Beowulf*, *Siegfried*, *Aegir*, and *Odin*. A reserve division has also been formed of certain armoured gunboats, two light divisions of small cruisers and despatch vessels, and two torpedo flotillas. A pamphlet, which has aroused a good deal of interest in German naval circles is that published by Vice-Admiral Valois. He holds, as do the naval experts of many other countries, that the proper way to attack England is to build a large number of cruisers and prey upon her commerce, and states that the naval preparations of his country must be directed against Great Britain. The pamphlet has been adversely criticised, however, by some of the leading German newspapers, who pertinently ask what would happen to the coast of Germany, her commerce, her trade, and her industry during the course of a long contest for the destruction of England. As the *Times* correspondent at Berlin points out, the object of the present naval propaganda may be the creation of a fleet able to dispute with England the command of the sea, but it is extremely doubtful if this object will ever be realised

The Shooting of Jules Lothe.

The unfortunate death of a French fisherman caught in the act of poaching in English waters has caused a good deal of ill-feeling between the fishermen of the north of France and those of this country. No blame can possibly attach to the commander of the *Leda* for the accident, despite the official report of the captain of the lugger. The latter declares that he was fired upon both by the *Leda's* whale-boat and from the gunboat herself, and that the fatal discharge was fired as the vessels were side by side. He further says that the gunboat could have arrested him without firing upon his boat. Every means of stopping the *Etoile de la Mer* was tried before it was found necessary to fire upon her, and if anyone is responsible it is Captain Delattre. It is ridiculous to suggest that the big guns of the *Leda* might have been used to disable the fishing-boat, especially at night, and considerable loss of life might also have resulted from ramming, so that the course adopted by Commander Maud was the only one left open. Several of the French papers have expressed their regret that the *Leda* did not exhaust every means of capture before firing, although it is admitted that the commander was within his rights in doing so. The expression of regret is wasted, for it was amply proved at the Folkestone inquiry that every chance was given to the Frenchmen of surrendering before extreme measures were taken, and the fact that the chase occupied an hour and a quarter verifies this.

Chatham Dockyard.

All the cruisers specially commissioned at this port for the Naval Manœuvres have now been paid off and put out of commission, so that the yard has once more resumed its normal appearance. There were several defects requiring attention, in the ships of the destroyer instructional flotilla, in readiness for the cruise which commences on the 5th of this month. It is probable that the *Venerable*, which was commenced on January the 2nd last, will be launched early in November, although the launch was originally fixed to take place about the middle of this month. The delay has been caused by the outgoing of Admiral Andoe and the incoming of Admiral Holland. Preparations are being made here for a new battleship to be commenced on the slip vacated by the *Venerable*. The vessel will be of the same type as the *Duncan* and the *Russell*, recently commenced at the Thames Shipbuilding Co.'s yard. £10,000 is to be spent upon the refit of the *Hawk*, which struck her pennant early last month, after having served on the China Station for six years. The *Irresistible* should by this time have her submarine tubes and underwater fittings completed. She will probably be ready for sea by the middle of next month. Instructions have been received that the *Goliath* is to be completed as quickly as possible, in order that her gunnery trials may at once take place. The *Dreadnought*, which, it will be remembered, grounded on the shingle bank off Shoeburyness just as her gun-mounting trials were to take place, will have to be docked in order that the damage done to her keel can be attended to. The Admiralty propose to spend the sum of £20,000 on a new building slip for this yard during the current financial year. Very little, however, has been done up to the present time. The refit of the *Immortalite* is to be completed by the end of December, and although the spending of £30,000 on repairs to her hull and machinery has not yet been approved of by the Admiralty, the work is to be taken in hand at once.

Speedy Cruisers.

It has been stated by many well-known engineers that the turbine-driven steamship will in all probability make its appearance before the twentieth century is far advanced, and that it will mark a new era in the history of steam. The Hon. C. A. Parsons, the owner and designer of the *Turbinia*, is presumably of this opinion, for in *Cassier's Magazine* he has a most readable article on the development of the turbine and its application to naval purposes. He is in favour of the building of an armoured cruiser fitted with his invention, and hints that the construction of such a vessel will be attempted before long. The ship would be of 3,000 tons displacement, 450 ft. length, 42 ft. beam, and 14 ft. maximum draught of water, carrying turbine engines and boilers of 120,000 maximum H.P., the boilers being of the water-tube type arranged in two tiers. This vessel, he continues, could steam economically at 16 knots speed, but would in an emergency be capable of increasing her speed to 48 knots, and maintaining this speed for three hours, or she could maintain a speed of 45 knots for eight hours. She would be difficult to hit with shot, and her speed being 18 knots greater than that of any locomotive torpedo, she would well take her chance in this respect. Mr. Parsons thinks—and it is just possible he is right—that a few vessels of this kind would be valuable additions to the British Navy.

They would be valuable additions to any navy, provided they could be built and made to answer expectations. Perhaps the company in which Mr. Parsons is interested intend constructing an experimental vessel.

General Willis and the "Naval Annual."

The attack made upon the *Naval Annual* by General Sir G. Willis has done little more than make that officer appear foolish in the eyes of those interested. He suggested that the book contained confidential information such as would be valuable to foreign Powers, but this was entirely disproved. It was admitted that the Admiralty had occasionally given assistance to the editor of the *Annual*, the Hon. T. A. Brassey, but nothing which would have been refused to other publications if asked for. General Willis has only just discovered that in one of the volumes published many years ago, the most secret details pertaining to the Spithead and other forts for the defence of our shores, which never could be known to an enemy if they had not been printed and depicted in that book, had been given. Now, the article in question distinctly stated that the information was a series of extracts from a lecture read by Colonel Inglis R.E., at the Royal Artillery Institute, Woolwich, in 1880, and if anybody knew this, Sir George Willis ought to have done so It should be mentioned that the *Naval Annual* was produced at a loss for several years after it was first started, and it is now admitted to be the best and most authentic publication of its kind The real cause of the attack on the *Naval Annual* apparently lies in the fact that the Hon T. A Brassey, the editor of the *Annual*, is a candidate for Parliament for the Christchurch Division of Bournemouth, and that General Willis is presumably opposed to his election. In view of the answer he received in the House of Commons he ought to tender an apology to Mr. Brassey.

Sheerness Dockyard.

A large amount of overtime has been worked at this yard recently, but it is probable that some cessation will now take place, as the Admiralty have directed that overtime is to be reduced as far as possible. The machinery and boilers of the new sloop *Condor* have now been delivered, and it is expected that she will be completed some time before the *Rosario*. She is the first sloop to be fitted with Belleville boilers, with which the *Rosario* is also to be supplied. Both ships have been masted, and, we are told, are to be rigged upon similar lines to the *Torch* and *Alert*. A good deal of work will have to be put into the gunboat *Niger* before she is able to resume her coastguard duties in Scotland. There was a great deal to do to her when she came here in July to have her defects attended to, and when she was despatched for the manœuvres part of this work was still unfinished. The annual overhaul and repair of the *Alarm*, a vessel of the same class as the *Niger*, has now been completed, the vessel having been in hand two months, and she is now quite ready once more to resume her work in the North Sea. The gunboat *Goldfinch*, which is returning home after serving three consecutive commissions on the Australian Station, is to be immediately taken in hand for a further period of foreign service. The *Perseus* is to be completed in readiness to commission on the 25th of this month for service on the Mediterranean Station, where she will relieve the *Salamander*.

The "Ocean" and "Canopus" on Trial.

According to all accounts, the preliminary trials of the new first-class battleship *Canopus* were not as successful as could be wished for, but too much importance should not be attached to the results of the one-fifth power trial. The *Canopus* lost a good deal of water owing to leaky joints in her tubes, and this probably accounts in some degree for the unexpectedly high coal consumption. On the other hand the preliminary trials of the *Ocean*, a sister ship, are said to have been very successful. The conditions of the second 30 hours' coal consumption trial were that a mean I.H.P. of 10,000 should be developed continuously whilst it was in progress. The *Ocean* successfully carried out these requirements, the machinery working without a hitch. The mean results were :—Steam in boilers 258 lbs.; at engines, 221 lbs.; vacuum—starboard, 27 in.; port, 26 in.; revolutions—starboard 101·9, port 103·1; I.H.P. —starboard 5,084, port 5,230. Total, 10,314; air pressure, *nil*; speed, 16·2 knots; coal consumed per I.H.P. per hour, 1·6 lb. The coal consumption of her full power trial was not taken, but the speed obtained is given as 19 knots. Three of the class of ships to which the *Oceana* and *Canopus* belong will, early next year, be ready for the pennant, there being the *Goliath* building at Chatham, in addition to these two. It may be mentioned here that the *Goliath*, at Chatham, has now received all her armament, and that she is to commence her gunnery trials almost at once.

The "Powerful" and "Terrible."

It has more than once been suggested in these columns that if the *Terrible* had been sent away to a foreign station in the same way as the *Powerful*, she would have been by this time as great a success as this ship has proved herself. The news to hand, that at last this course is to be adopted, suggests that the Admiralty are also of this opinion. The *Terrible*, in fact, is to be sent to relieve the *Powerful*. According to an account recently received from the China Station, the *Powerful* has made another successful trial. Leaving Hong Kong on June 14th for Wei-Hai-Wei, she steamed at easy speed for three days, but when within 600 miles of Wei-Hai-Wei she started on her full-power quarterly trial. According to one report, the coal was small and the boilers dirty from previous use; but despite these drawbacks, the *Powerful* managed to keep up a speed of 20·8 knots for four hours, with H.P. of between 24,000 and 25,000. For the next 12 hours the vessel went forward at a speed of 20 knots, and would probably have kept this up for a longer time had not a dense fog come on and caused her to slow down. We are informed that during the run everything worked well, and that no defects of any kind revealed themselves. This demonstrates in the clearest manner that the water-tube boiler is not nearly the failure which Mr. W. Allen, M.P., would make us believe. There is little doubt, however, that the fleet engineer of the *Powerful* has had a great deal to do with the successful working of the *Powerful's* machinery, as Mr. Edwards, in addition to being a thoroughly practical administrator, is a man of science, and must have worked up those under him to a high state of efficiency to obtain such favourable results. The *Powerful* will probably make a record passage home.

Pembroke Dockyard.

It has been found that it will not be necessary to remove the non-inflammable wood which has been used in the fittings of the new Royal yacht. This wood has been chemically treated, and can now be painted in a proper manner. It was originally thought that, as a result of the chemical treatment to which the wood had been subjected, it would be too wet to paint, but it has now been dried somewhat with the aid of charcoal fires. A similar course, it should be mentioned, has to be adopted where the wood is used in vessels of the Navy of the United States. The new yacht is to be sent to Portsmouth for completion next month. She will probably be ready for commission next summer. It is rumoured that the command of the present Royal yacht is to be given up by Admiral Fullerton on account of ill-health, and that she will be taken over by Captain Curzon Howe, whose period of service in the traning ship *Britannia* terminates in April next. The cruiser *Spartiate*, which is completing at this yard, has had all her funnels placed in position, and altogether good progress is being made on her. She was laid down in May, 1897, and launched at the end of October of last year.

The Water-Tube Boilers during the Manœuvres.

Immediately on top of the denunciation of the water-tube boiler in the House of Commons by Mr. W. Allen, M.P., the reports came to hand of many successes achieved during the recent manœuvres with this type of boiler. The thick clouds of smoke that poured from the funnels of the new cruisers is, it is admitted, a defect, but one which can be overcome. Great strains were frequently put upon the machinery and boilers of the vessels fitted with the Belleville boiler, but their efficiency was proved by the ease with which they answered every call made upon them. At times the speed of some of the cruisers was increased from 8 to 18 knots in less than three minutes, a feat which would have been quite impossible with the Scotch boiler. The well-known naval writer, Mr. H. W. Wilson, who was afloat as the special correspondent of the *Daily Mail*, considers that "with careful stoking the water-tube boilers make no more smoke than the Scotch type." Of its steam-raising capacity, says he, "no one can have any doubt, and the vessels fitted with it can do their 18 knots at sea with ease for any time with moderately good stokers. It is, of course, where economisers are not fitted, exceedingly extravagant. Where these are carried, the expenditure of coal is nothing startling. For instance, one 11,000 ton cruiser with Belleville boilers (economisers fitted) made the voyage from Portland to Belfast, round the west coast of Ireland, on 343 tons of coal. She did three hours at 18 knots, three hours at 14 knots, 40 hours at speeds of 10 to 12 knots (with steam always in hand for 12 or 13 knots), and some hours lying-to or going at low rates. This consumption included everything. If you want slow ships, put in the Scotch boiler and see enemies steam gaily out of sight."

UNION DOCKS, LIMEHOUSE.

In our last issue we gave a short notice of the opening of a new dry-dock on the premises of Messrs. Fletcher, Son, & Fearnall, Limited. We have now the pleasure to supplement our description, and to illustrate the work by the adjoining diagrams.

Fig. 1 is a cross section of the dock, the pump, well, and engine room. It shows the general design of the body of the dock; there are altars in the side ways of 18 in. and 24 in. in width respectively, placed at levels of 5 ft. and 12½ ft. below the coping, and the side walls have a batter of one in six, with a bold curved base and gutter at the dock bottom. The work is of Portland cement concrete throughout, with a watertight skin of cement compo rendering under the bottom and up the backs of the side walls to the level of Ordnance Datum, which is above the permanent level at which the land springs stand.

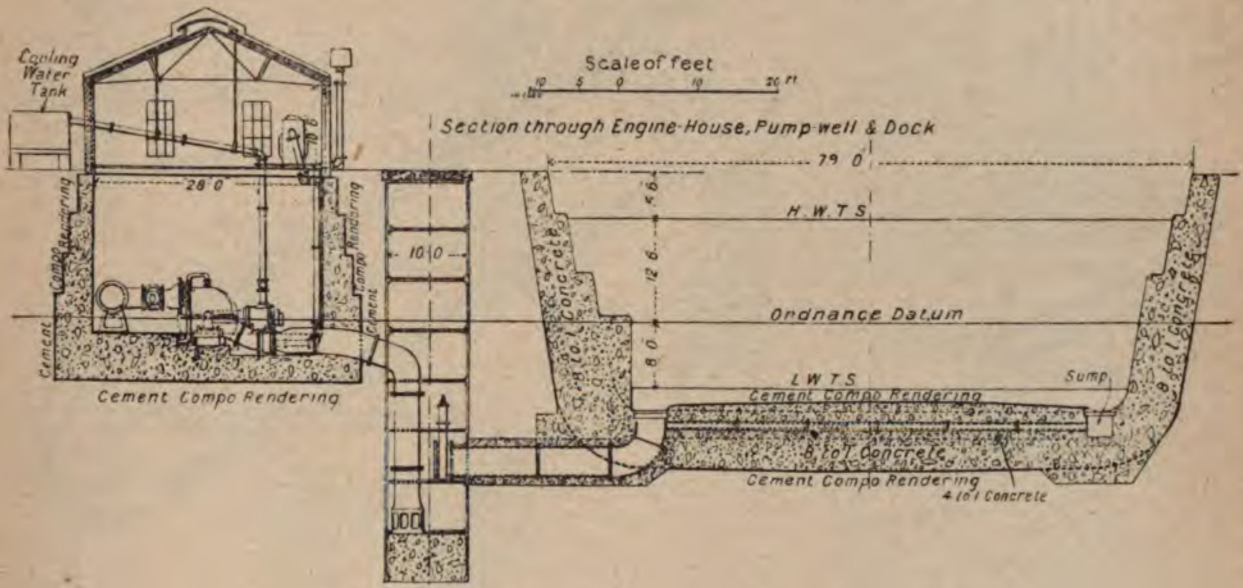


Fig. 1.

For filling the dock with water, sluices have been provided through the gates of sufficient area of opening to fill the dock in 15 to 20 minutes, and for emptying the dock an installation of pumping plant has been erected which will empty the dock without a vessel in it in two hours. This plant, which has been supplied by Messrs. Gwynne & Co., Brook Street Works, Holborn, London, E.C., consists of two centrifugal pumps with suction pipes of 26 in. diameter, each driven by a gas engine of 140 indicated and one pump with a suction pipe of 10 in. diameter, driven by a gas engine of 60 I.H.P. This smaller pump is for drainage purposes. The engines and pumps are placed in the engine room, which is 50 ft. long and 28 ft. wide; the floor is at the level of about 20 ft. below the coping level of the dock.

The pump well is a cast iron cylinder of 10 ft. internal diameter and is sunk to 50 ft. below the coping level. The culvert from the dock to the well and the discharge culvert from the engine house to the river are cast iron pipes 3 ft. 6 in. diameter, surrounded by concrete 12 in. thick. In the well an opening has been provided at a suitable level for a cast iron culvert to connect with the middle and upper docks.

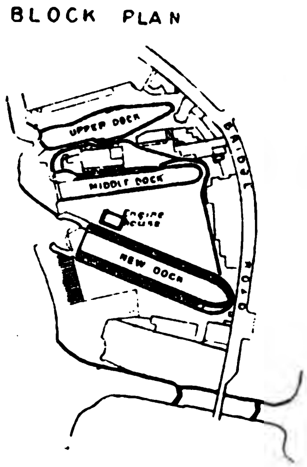
Fig. 2 is a plan of the new Dock, and Fig. 3 is a plan on a smaller scale, showing the relative positions of the upper, middle, and new docks. The engines were made by Messrs. Crossley Bros., Limited, of Manchester, and are of their high speed type, specially designed for driving centrifugal pumps and dynamos. They are supplied with coal gas from the public mains and on full load run 190 revolutions per minute. The engine crank shafts, which are steel forgings, are fitted with heavy cast iron counterbalance weights to ensure steady running. Each engine is fitted with two flywheels 7 ft. 3 in. diameter, and 10¼ in. wide on the face of the rim, and has a high speed centrifugal governor, by means of which the speed of the engine can be regulated while at work. This enables the engine to run slowly when the dock is full, and the attendant can gradually increase the speed as the duty increases. This ability to vary the speed is very important, it is claimed, in order to obtain the most economical working results. Each engine is coupled direct by a centrifugal pump, in one case by a flanged coupling and in the other by a jaw coupling. The latter engine is to be used occasionally for driving a dynamo, hence the necessity for being able to disconnect the pumps.

The 60 H.P. engine which drives the 10 in. centrifugal pump which is for keeping down the leakage in the dock, also drives a vacuum pump for exhausting the air from the suction pipes and cases of the main centrifugal pumps at starting. Each of the pumps is fitted with a sluice valve on the suction pipe and with a sluice and reflux valves on the delivery sides. The general arrangement of the engines is clearly shown in Fig. 4. As seen in Fig. 1, which shows the arrangement of the engine-house below ground, it will be obvious that this arrangement has a twofold advantage. Firstly, valuable space is saved near the dock; and secondly, the length of the suction pipes to the pumps are reduced to a minimum.

It will generally be admitted that undoubtedly gas engines have many advantages over steam engines for work of this class, as the preliminary expenses of raising steam are avoided, and the motive power being always at hand the engines can be started immediately they are required at short notice; and moreover the consumption of fuel ceases as soon as the dock is emptied.

We have had the opportunity of examining the work and can add our testimony that it is of the most up-to date description, the dock being provided with every possible arrangement of labour and time-saving appliances. The new addition to docking accommodation on the Thames should prove of great benefit both to ship owners and the firm who have had the enterprise to bring it into being.

Messrs. Kinipple and Jaffey, of Westminster, were the engineers for the works, and Messrs. Kirk & Randall, of Woolwich, the contractors.



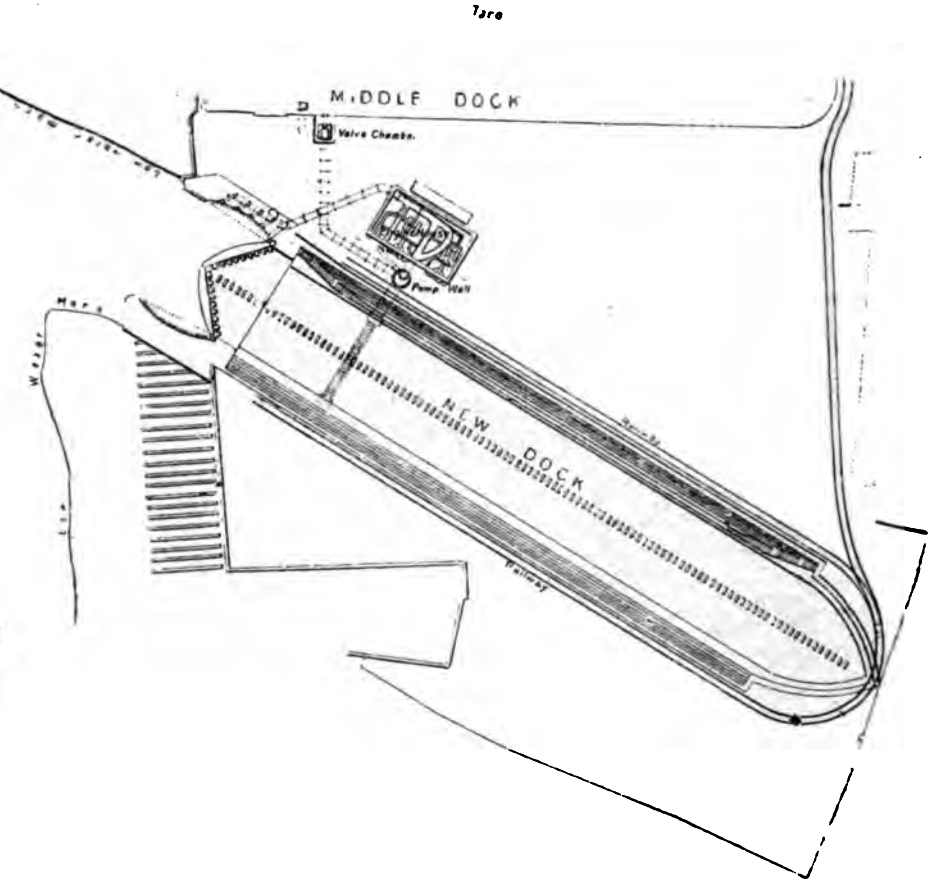


Fig. 3. Union Docks, Limehouse. Fig. 2.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

THE scheme for the National Physical Laboratory has been advanced a step. It will be remembered that the Treasury appointed a committee, of which Lord Rayleigh is chairman, to make an enquiry into the necessity for such an institution, and, after an exhaustive enquiry, this committee has brought in their report. The evidence showed that there was a necessity for a place where instruments could have authoritative standardisation and where also researches could be conducted having special reference to the industrial requirements of the country. There are supposed to be facilities for testing and certifying electrical instruments at the Board of Trade, but these are of the most meagre description, and in future such work will be done at the National Physical Laboratory.

Standard gauges at Elswick and Woolwich did not compare well together. They were found to differ quite appreciably. The same condition of things was found to exist in the Indian and home arsenals, and there was no central authority to settle the point and declare who was right. At Kew sextants can be tried and certificates issued showing the errors of division at different parts of the scale. There is no central institution, however, for electrical instruments being tested. The electrical engineers who gave evidence spoke to the advantage the Reichsanstalt conferred in Germany, and sometimes electrical engineers of this country had to obtain assistance from it. The Treasury is the authority for laying down the lines on which the laboratory shall be worked, for it is the Treasury which finds the money. It has endowed the laboratory with a sum of £18,000 for buildings and a yearly grant of £4,000, which, however, will be increased as necessity arises. There are to be 36 members on the governing body, 24 of which will be supplied by the Royal Society, and 12 by three institutions—the Iron and Steel Institute, the institution of Naval Architects, and the Society of Chemical Industry. Precaution will be taken to keep the institution always in touch with the existing indus-

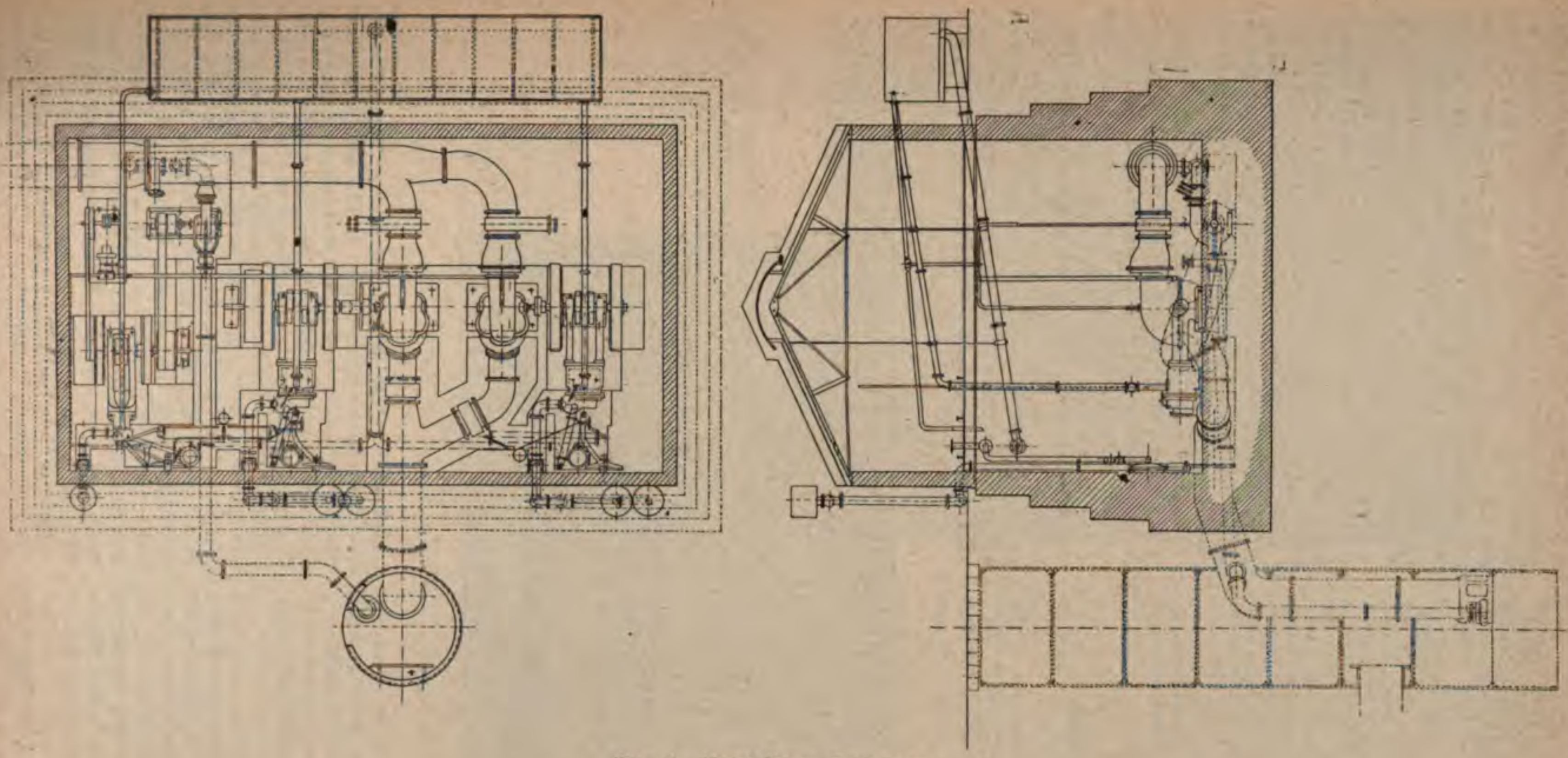


FIG. 4.—UNION DOCKS, LIMEHOUSE.

tries, so half the members of the executive committee will be from the above institutions. Should any member of the executive committee fail to attend half the number of meetings he will not be eligible for appointment again for twelve months. The executive committee will produce the annual report of the work done in one year and of the programme of experimental work for that ensuing. The following are the present executive committee: Lord Lister, P.R.S.; Lord Rayleigh (chairman); Mr. A. B. Kempe (treasurer R.S.); Professor A. W. Rucker (secretary R.S.); Sir Courtenay Boyle; Captain Abney; Sir N. Burnaby; Mr. G. Beilby; Sir E. H. Carbutt, Bart.; Captain E. W. Creak, Professor R. B. Clifton, Professor G. C. Foster, Mr. F. Galton, Professor O. J. Lodge, Sir A. Noble, Professor J. Perry. Sir W. Roberts Austen, Professor A. Schuster, Mr. A. Siemens, General Sir A. Strachey, Professor J. J. Thomson, Dr. T. E. Thorpe, and Sir J. Wolfe Barry. This executive committee have the power to appoint sub-committees, the members of which are not necessarily members of the governing body. The following are also members of the general board: Sir M. Foster, Sec. R. S., Sir F. A. Abel, Professor W. G. Adams, Professor W. E. Ayrton, Mr. H. Bell, Mr. A. Buchan, Mr. R. G. Crompton, Professor G. F. Fitzgerald, Professor J. Joly, Lord Kelvin, Mr. J. T. Milton, Sir, W. H. Preece, Mr. W. F. Reid, the Earl of Rosse, Dr. R. H. Scott, Mr. W. N. Shaw, Mr. C. E. Stromeyer, Admiral Sir W. Wharton, Sir W. H. White. The following have been asked to serve on one or other of the committees: Messrs. E. D. Archibald, C. V. Boys, Professor H. L. Callendar, Forbes Carpenter, W. H. M. Christie, J. H. Dallmeyer, Professor J. A. Ewing, Mr. S. Z. de Ferranti, Professor J. A. Fleming, Messrs. R. E. Froude, E. H. Griffiths, J. Mansergh, J. Mathews, W. H. Maw, Dr. L. Mond, Hon. C. A. Parsons, Professor A. W Reinold, Captain H. N. Sankey, Messrs J. Swinburne, G. J. Symons, H. A. Taylor, Professor S P. Thompson. J. I. Thornycroft, C. H. Wordinham, and A. F. Yarrow

We note in the regulations that 12 of the governing body shall be elected by three engineering institutions. We wonder by what stretch of imagination the Society of Chemical Industry can be placed under this head. On the whole the selection for the committee appears a good one. But one institution has been left out, and we may have to return to this subject again.

Mr. William Froude, who made the classical experiments for the Admiralty on the propeller, and showed the advantage first of experimental models for deducing the reistance of full-sized ships, is succeeded by his son, Mr. R. E. Froude, F.R.S., as superintendent of experiments at the Admiralty experimental works, Gosport.

Whitworth Scholarships.—The following gentlemen are placed at the head of the Whitworth Scholarships list, and receive £125 a year for three years:—1. Alec W. Quennell (21), engineer, London. 2. Hanson Topham (22), engineer, Great Horton, Bradford. 3. William V. Shearer (21), engineering student, Langside, Glasgow. 4. George Wall (25), student, Oldham.

The Spanish-American sea war has created a new life in the yards of the United States. The little repairing shop of the Moran Bros. Co., at Seattle, on the Pacific coast, has developed into a yard covering an area of 14 acres, having a frontage of 700 ft. on Elliott Bay. There are a machine shop, pattern shop, foundry, blacksmith and boiler shops, and all the other shops for a complete engineering company. Lately it built 12 stern wheel steamers for the Yukon river trade, the dimensions were 175 ft. long, 35 ft, broad, and 6½ ft. deep. Engine cylinders 20 in. in diameter, 7 ft. stroke. There is to be a floating dry dock 400 ft. long, built in two sections. There is to be a 75-ton crane also erected.

The South Wales centre of the Institute have brought forward a proposal for the better accommodation of the members. Some little modification at the Stratford centre may permit of this being done.

"VRIL" ELECTRIC LAUNCHES.

In the adjoining illustrations we show one of the electric launches built according to the "Vril" system. Fig. 1 shows a boat constructed for the Morecambe Electric Launch Syndicate running at full speed. Fig. 2 shows the same boat looking from above, giving an idea of the seating accommodation. Fig. 3 is an outline diagram showing the plan and cross section, and the arrangement of motor and accumulators.

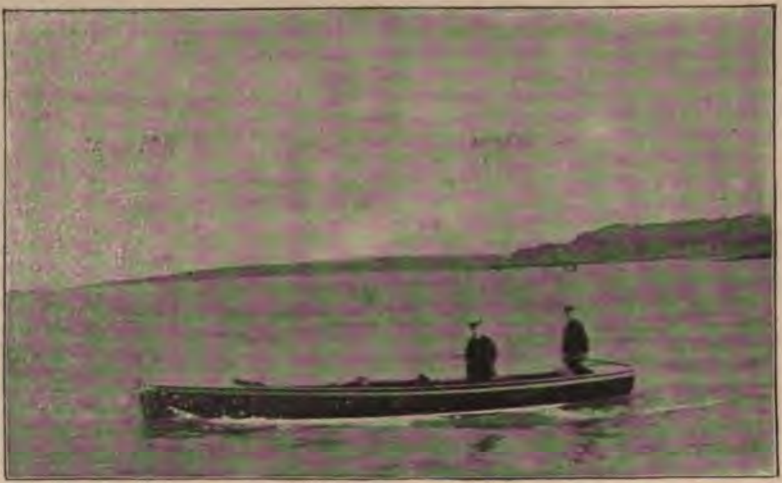


FIG. 1.

This boat has been built on new lines, and was intended to run at a speed of seven miles per hour; however, on trial, it was found that a speed of 8¼ miles per hour for five hours could be maintained. The length of the boat is 28 ft. over all, and 27 ft. 6 in. on the water line, the beam is 6 ft. 6 in., the depth 3 ft. 4 in., and the draught about 1 ft. 9 in. She is carvel-built of mahogany, and is copper and yellow metal fastened throughout.

The propeller, which is of gun-metal, is driven by *one of* the "Vril" patent motors. The special feature of this motor is the provision of special means whereby the great difficulty is entirely overcome of controlling the speed and output of the motor, without the aid of external resistance or alteration in the connections of the batteries. The common method of getting two or more speeds is to arrange that the cells are grouped into one, two, or more sets in series for full speed and in parallel sets for other speeds. This in course of time leads to trouble with the cells, owing to the impossibility of running cells in parallel without some complicated arrangement to regulate the discharge from each individual group. In the "Vril" system the cells are always in series, and the full voltage of the battery is always on, the various speeds being obtained by alteration to the motor circuits only.

The motor is controlled by a Callow-Eck patent controller, which gives two speeds ahead and astern. These are adapted to give an absolutely instantaneous make and break from and to any point, and have large contact surfaces to ensure cool working.

The motor is adapted to work a reciprocating bilge pump so as to keep the boat clear of water. The accumulators are constructed on the "Vril" system with improved connecting lugs, placed in ebonite boxes with rebated edges and acid-tight ebonite lids, and sealed with "Okonite" special paste. The cells are fitted with double rubber rings on the connecting lugs making an absolutely acid and water-tight battery box and entirely preventing acid spilling out of the cells through the rolling and pitching of the boat. It is also claimed that this overcomes the difficulty arising from the connections of the cells corroding through the creeping of the acid up the lugs to the terminals. The gases given off during charging are led away by a ventilating plug clear of the terminals, thus leaving the connection from cell to cell a sound mechanical and electrical connection; a matter of great importance, and one that has hitherto given considerable trouble.

Okonite insulated cables are used throughout, as it has been found, we understand, from long experience that nothing will stand acid, acid fumes, seawater, oil and the generally damp conditions that appertain to marine or river boat-work, and at the same time maintain its high insulating qualities so well as this kind

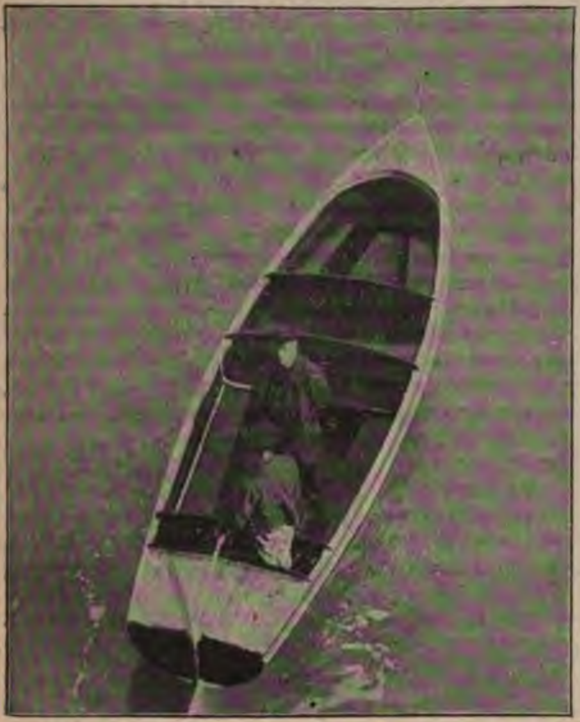


FIG 2.

of cable. The cables are sheathed with lead to protect them from mechanical injury.

The seating capacity of the boat illustrated is 22 passengers in addition to the steersman.

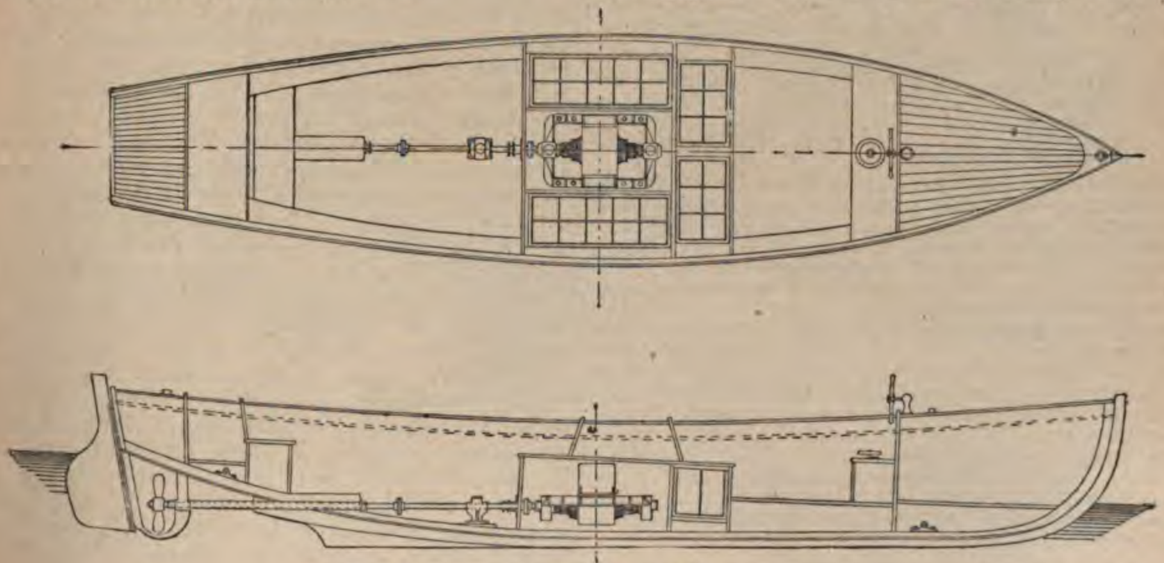


FIG. 3. "VRIL" ELECTRIC LAUNCHES.

The boat was constructed in accordance with the designs of Mr. Cecil Callow, by the "Vril" Launch Co., of St. Helens, Isle of Wight, whose selling agents are Messrs. Laing, Wharton & Down, Ltd., of London and Leeds. During Cowes week Messrs. Laing, Wharton & Down were commanded to exhibit the properties of a "Vril" launch to H.R.H. the Prince of Wales, who was so satisfied with the boat shown that he, accompanied by the Duke of York, went a trip in it round the yachting fleet.

ELECTRICAL NOTES.

(From our own Correspondent.)

THE United States stole a march on this country in fitting many of the auxiliary machines on board battleships with electric motors, and now they are again first in the field with *Electrically propelled Ferry boats.* These have soon to be started on the Delaware River between Philadelphia and Camden, New Jersey. It will not be difficult for electric arrangements to show a higher efficiency than steam, since with ferry boats there is waiting at the piers, and only a limited amount of time is taken up in crossing and the fires must burn whether the boat is standing or in motion. With steam there is not a high efficiency. With electrically fitted boats the power is completely cut out when the boat is at the pier, so there is no waste there. The efficiency of the electric is the efficiency of the system on board the boat whilst the ferry boat is in motion. In the case of the electric motor fitted on board and with batteries to run the motors the charging is very simple. It can be done whilst the boat is in the slip at the end of each trip. Under these conditions the batteries would always be at full charge, and when these are in full charge their efficiency is very high indeed. The ferry boats may thus be expected to show a saving in coal. But there will be other gains following on the displacement of steam machinery with accumulators and motors. All the space on the main and upper decks which is usually occupied with working beams, smoke stacks, &c., will be saved The attendance will be reduced to a minimum, there will be less vibration, the control gear put in the pilot house, and the steersman may operate the motors. The control will be very simple, and no chance of error by signalling, since the same man who steers directs the motor.

Electrically Driven Barge.—There has been placed to run on the Mersey an electrically equipped barge, the installation consisting of storage batteries and a motor. The length of the vessel is 75 ft., and its displacement 225 tons when fully loaded. The equipment consists of 112 storage battery cells, each a lead-lined teak box, 16 in. by 22 in. by 14 in., containing 29 plates $9\frac{1}{4}$ in. high, 12 in. broad, and half inch thick with ebonite separators. The cells are sealed to prevent the acid solution spilling, and each cell has a fume outlet connected by lead piping with the open air. There are two 40 H.P. motors taking a current of 150 amperes at 200 volts, each motor works its own screw. A Hopkinson series control is used for varying the speed of the vessel. There are five speeds and a reversing switch under the control of the steersman. The space taken up by the installation is less than would be taken up by a steam engine and boiler of the same power. It is said that the speed of this barge is greater than that of similar barges driven by steam.

Electrical Refrigerator.—A Scotch electrician is said to have brought out an electrical refrigerator. The current is used inside for driving off the ammonia. There are no moving parts. Machines are said to be under construction for the production of 100 lbs. of ice per day.

A Water Automobile.—There is first a light raft on which the vehicle is placed. A chain is thrown off a sprocket wheel and causes the transmission of power to the wheels of the motor car. It is attached to another sprocket wheel which causes the propeller shaft between the two cylinders to rotate at any desired speed. The man acts as driver and steersman. There are two upright handles in front of him, one to manipulate the machinery, the other the rudder.

Power by the Tides.—We have always felt a certain fascination for this subject, but never could get proper *data*. We are at last, however, supplied with *data* as to what could be done at Pont-L'Abbé Finistère, France, where the tides are utilised during 14 hours per day in generating power. At flood tides the water flows through a canal two and a-half miles inland, into a pond in rear of the power house, receiving the water, which returns to the sea at ebb-tide. The total fall is from 6½ to 7½ ft., and 80 H.P. are generated by means of turbines. The turbines are to be used for the generation of electricity.

Test of Electric-Driven Fans.—The comparative test of 12-in. electric fans of five different types, was made by Messrs. J. T. Mountain and E. A. Hughes, of the Engineering department of the University of Michigan. Three of the fans were driven by direct-current motors and two by alternating current. The principal point to be ascertained was the "gross efficiency." This was the ratio of the useful work done by the fan compared with the work put into the motor. The air displaced per minute was measured by means of a large airtight rectangular box. The fan discharged into one end through a 12-in. circular opening, and the volume of air measured at the other end as it issued through a 17-in. circular opening. The outlet was divided into eight zones, and the average velocity of the air through these taken by means of a calibrated anemometer. The results are given below:—

No. of Fan.	Kind of Motor.	Efficency.	Weight of air moved per second per watt input.
			ounds.
No. 1	Direct Current	33·35	·0374
,, 2	,, ,,	21·06	·0229
,, 3	,, ,,	19·70	·0211
,, 4	Alternating ,,	14·40	·0171
,, 5	,, ,,	9·37	·0154

The results showed that direct-current fans are more efficient than alternating-current fans. Fans with straight blades were more efficient than curved blades. A straight-blade fan delivered 944 cubic ft. of air per minute, whilst a curved-blade fan running at the same speed displaced only 844 cubic ft. of air per minute. The rise in temperature of direct-current fans was comparatively very small.

Marconi's Telegraphy at the Manœuvres.—The plan of the Naval Manœuvres was a protecting fleet for an expected transport, and a hostile fleet to try and capture it. The transport was to be on its way from America, the protecting fleet was to find it. The transport had fitted on board an installation of Marconi's system, so had the protecting fleet. When searching for the transport a ship of the protecting fleet discovered its position by means of the wireless telegraphy at a distance of 30 miles, and again at a distance of 25 miles. It is said that by a system of cruisers at a distance of 50 miles from each other, a complete system of detection could be maintained.

The Helicoid Locknut Patents (Parent) Co., Limited, whose speciality the Automatic Locknut (a coil of steel of immense power) is finding favour with all users, notify that their offices have been removed from 147, Dashwood House, New Broad Street, E.C., to Acton Hill Works, Acton, W.

HOMACOUSTIC SYSTEM OF VOICE-TUBES.

THE essential features of a voice-tube should, no doubt, be for maritime work, to clearly transmit and receive without mutilation the messages to and from the bridge to the engine-room, and various other important stations with absolute certainty, without restrictions as to rapidity of speech, or modulation of the voice, and to accomplish it while a high rate of speed is being maintained, notwithstanding the din of machinery, the vibrations of the vessel, the interception by extraneous sounds, and the roar of the gale or of gun-fire.

We have, on a previous occasion, given a description and illustration of the Homacoustic system of voice-pipes, but in view of the fact that considerable improvements have been effected in the system of late, it affords us much pleasure to again refer to the subject.

Referring to the illustrations, Fig. 1 shows the new type of apparatus, termed the Admiralty pattern. Fig. 2 shows a quartermaster delivering orders to the engine-room from the fore-and-aft bridge. Fig. 3 shows such an instrument being used, having a 5-way switch-plate at the base, but which are made for the various number of tubes required. Figs. 4 and 5 are views of the new insulating and watertight bulkhead-piece.

Dealing now with instruments themselves, it will be seen that they consist of three essential elements—viz., a mouth-piece, two ear-pieces, and a whistle-signalling device. The passage from the mouth-piece to the conducting-tube is controlled by a plug-valve, so that in one position of the plug the passage is clear, and in the other position it is closed. To this plug at each end the ear-pieces are attached, so as to have communication with the central passage of the plug. Normally, the ear-pieces hang in their up-and-down or approximately vertical position, as shown in Fig. 1, when the mouth-piece passage is closed by the plug, and no air can escape except by the signalling-whistle. In this way the tube is in a condition for giving the signal for ringing up a person to give a message. To receive the message the person takes the ear-pieces, which are both telescopic and flexible, to allow of adjustment, and raises them into the extended position, as shown in Figs. 2 and 3, which action opens the plug-valve, and allows free communication to be set up between the mouth- and ear-pieces and the line-conducting tube, and conversation can be carried on.

In the case of an instrument being connected to a number of stations, a commutator or switch-plate is used, as shown in Fig. 3, which consists of a foundation to which the various tubes are connected at the bottom and arranged in a circle, and on the upper face thereof a movable disc-plate is mounted to pivot about a stud in the centre. This disc-plate has the same number of apertures as there are pipes, and over one aperture is fixed the speaking-and-hearing instrument, while over the others are placed small-hinged covers, which act as signals by being blown over by the pneumatic pressure sent along the tube, at the end of which is the cover, thus allowing the person at this instrument to ascertain which service of piping is being used, and showing over which tube he must turn his switch-plate to converse. Of course, if no

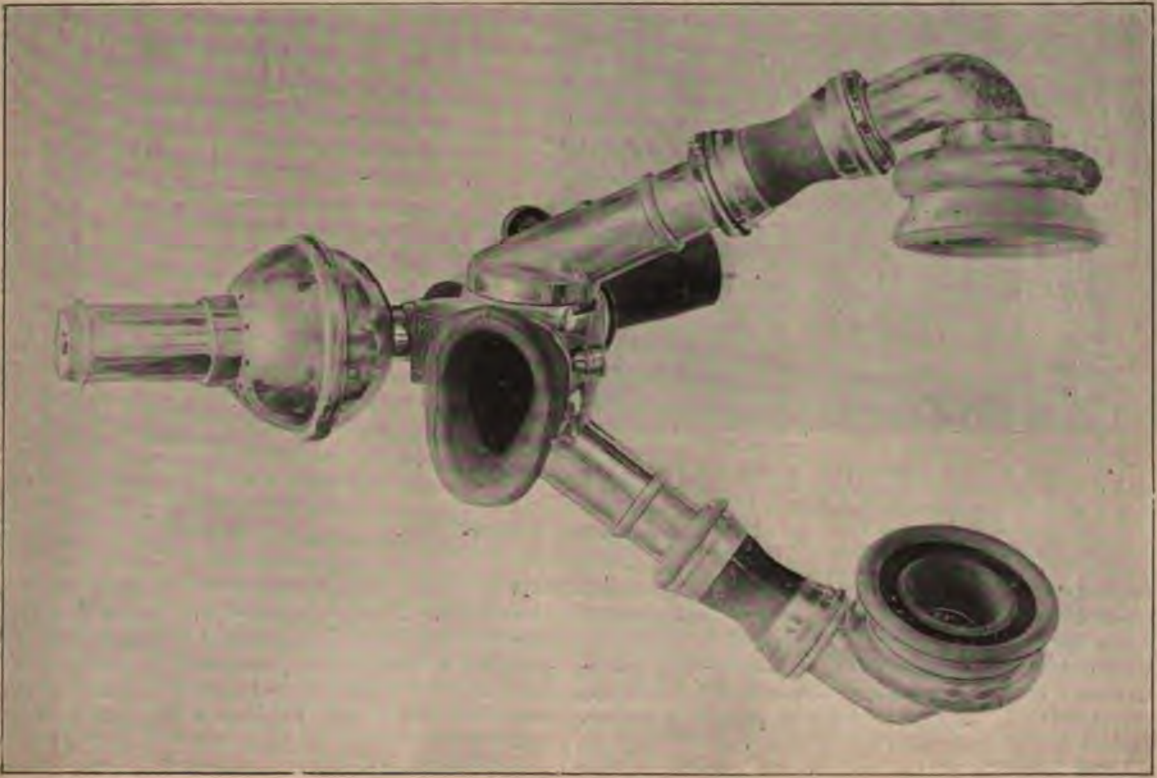


Fig 1.

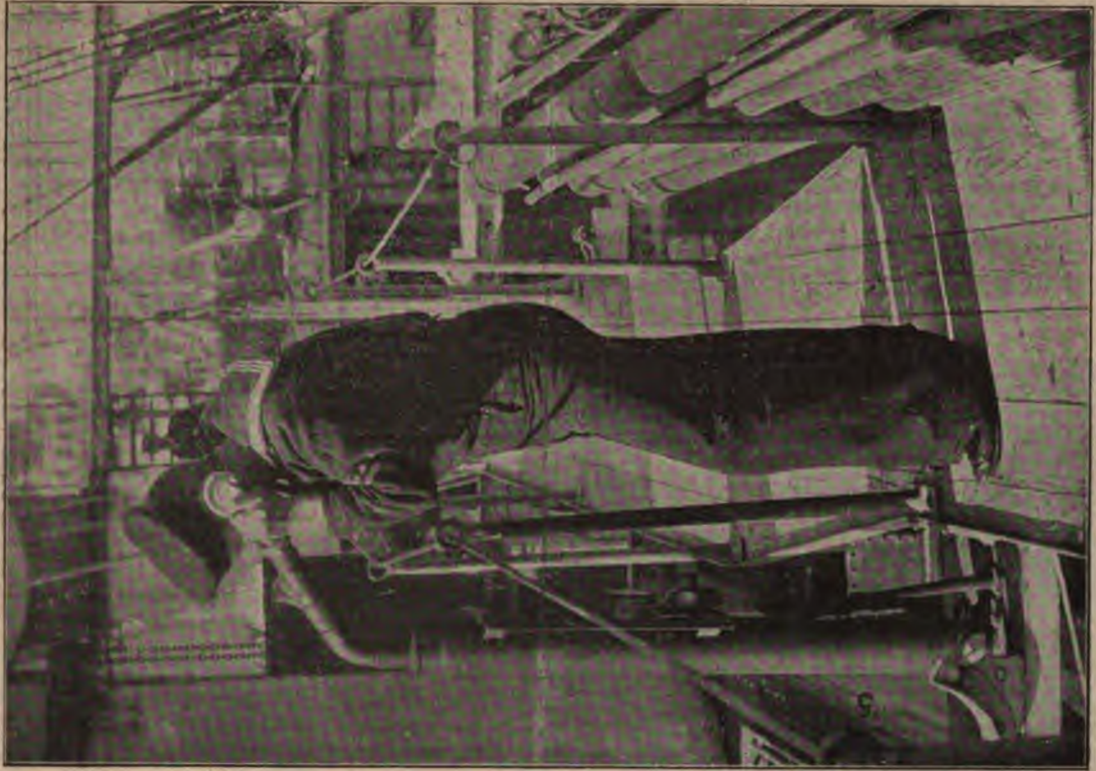


Fig. 2.

Homacoustic System of Voice-Tubes.

cover is blown over then the instrument happens to be placed over the proper tube, through which communication is desired to be made. This arrangement abolishes the multiplicity of mouth-pieces, and thus saves much space.

One of the great difficulties to overcome in the matter of voice-pipes on board ship has been the complete insulation of the installation from the effect of extraneous sounds. This has been carried out by the employment of a non-resonant alloy of metal for the conducting-pipes and the fixing of the latter upon the structure of the ship, so that there is no direct contact with any hard substance or part of the ship.

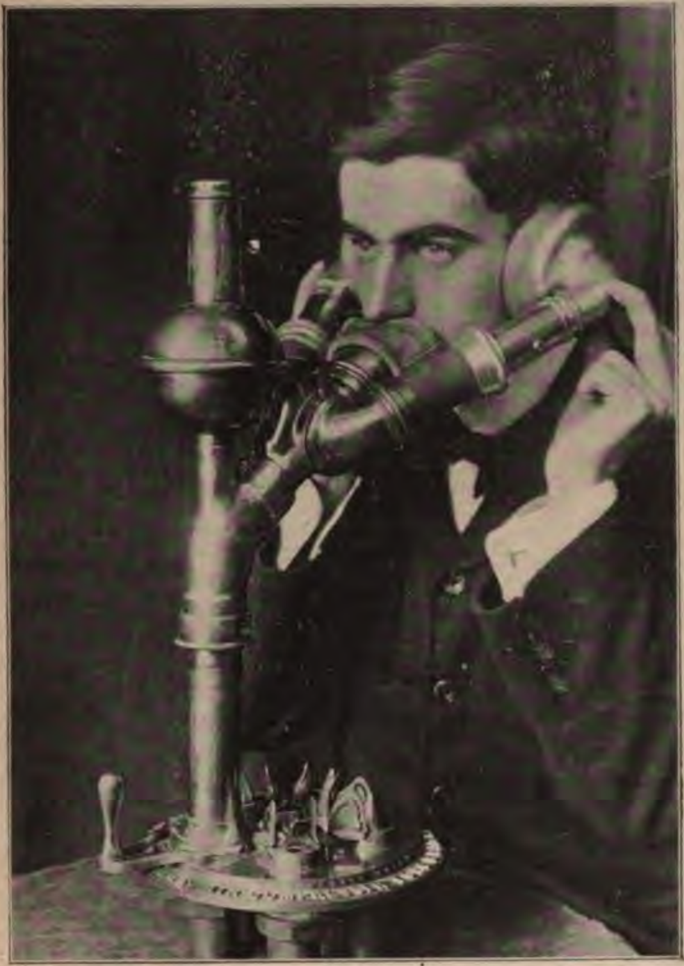


Fig. 3.

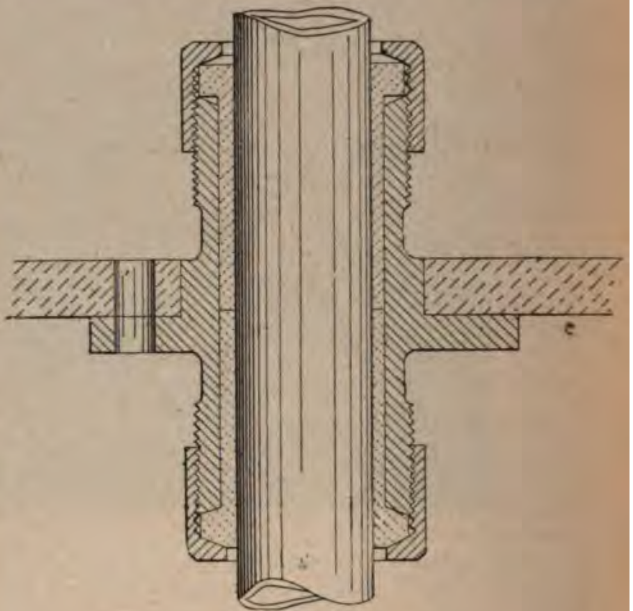


Fig. 4.

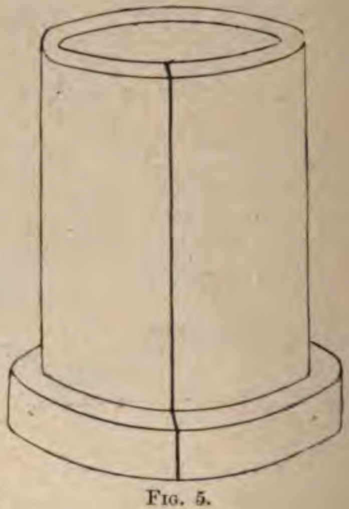


Fig. 5.

Homacoustic System of Voice-Tubes.

To effect this at the bulkheads, or water-tight compartments, a very ingenious and simple bulkhead-fitting has been devised, through which the pipe is threaded, and which are shown in Figs. 4 and 5. It may be mentioned that this fitting may be used for any other kind of pipe other than voice-pipes, which, in passing through a bulkhead, require a watertight joint to be made thereby. It will be seen from the illustration to consist of a flanged casting, having an internal recess and screwed nipples projecting on either side, upon each of which a coned gland-nut is fitted. The pipe having been threaded through this device and placed in position, the nuts are unscrewed, and a split indiarubber packing-piece is inserted into the central recess, the packing-piece having a collar or shoulder, serves as the washer which abuts against the end of the nipple. If now the nuts are screwed up against the packing-piece the latter is compressed, thereby forming a watertight joint, the pipe being practically held in suspension by the rubber sleeves, thus allowing for contraction and expansion in steam pipes, and water pipes, and at the same time insulating the pipe by means of the indiarubber-washer from any extraneous

vibration, as against voice tubes. We understand this device has proved a great success.

Considerable difficulty has been experienced from time to time in the proper transmission of certain words; for instance, "fifty" is often heard as "sixty," while "eighty" is readily distinguishable. This matter was carefully investigated by Mr. Cutmore, the inventor of the Homacoustic system, and it was discovered that by the use of a series of expansion-valves fitted to the pipes throughout an installation, the defects caused by loud and rapid talking were entirely eradicated, and the breaking up or mutilation of words obviated. This device has the effect of apparently reducing the actual distance of the speakers from one another to one-half. It also adds volume and intensity to the voice, rendering messages marvellously distinct and audible.

These voice-tubes have been adopted by the British Admiralty, the Austrian, Dutch, and other foreign navies. They are manufactured by the Homacoustic Apparatus Co., who are the patentees, at 115, Queen Victoria Street, London, E.C.

Reviews.

Steam-Boiler Practice. By Walter B. Snow, S.B. New York: John Wiley & Sons. London: Chapman & Hall, 1899.

Mr. Snow aims at treating his subject in its relation to fuels and their combustion on one side, and on the other to examine the economic results obtained with various methods and devices. His ten chapters thus divide themselves into two parts. The first five deal with the first sub-title of the volume. He shows in the initial chapter how many qualities—some of them apparently irreconcilable one with the other—have to be combined in a perfect steam-generator and that low consumption of fuel, though, of course, a very important quality, is not such as will enable others—such as the question of prime cost, durability, and quantitative efficiency—to be entirely disregarded. For marine purposes it may be added that considerations of weight involved and space occupied become of supreme importance. Having thus, as it were, cleared the ground, he proceeds to the consideration of the chemical and other properties of water and steam, and then to the chemical theory of combustion. Here he examines the chemical composition of various fuels, British and Colonial, as well as American, and liquid as well as solid. The amount of air necessary to be supplied for perfect combustion is then arrived at, and the fact remarked upon that, when mechanical stoking and the employment of forced draught is resorted to, the proportionate amount of the air supply can be diminished to a surprising extent. The means to be adopted for the purpose of examining the air supply and the flue gases is also described and illustrated. Then comes an examination of the efficiency of fuels. These, of course, have to be taken into consideration, from the practical point of view, in relation to their efficiency in the particular type of steam-generator employed and to their cost when delivered in the bunkers. This last matter is one to which—when we come to consider the cost of competition of various countries as coal-producers—too great attention cannot be paid. As the author says at page 127, "the cost of producing a given amount of steam is the ultimate criterion by which the efficiency of any fuel must be judged." "And," he adds, "the commercial efficiency not only concerns the amount of water to be evaporated by a pound of fuel, but is directly dependent on certain items of expense," which he enumerates. These include interest, rent, taxes, and insurance of the cost of the plant; depreciation, repairs, cost of water used, labour (including that taken up in getting rid of the ashes); and, lastly, the cost of the fuel delivered in the boiler-house.

Proceeding to the examination of the efficiency of the boilers, our author points out that the best basis of comparison is established when the evaporation is expressed in pounds of water evaporated per pound of combustible. But he adds that even this is subject to a modification, on account of the proportion of ash and elementary water in the coal.

The book concludes with an appendix containing very full rules as to the best means for conducting boiler trials.

What we have quoted from the volume is not, of course, new, but it shows that what the author has to tell will be found to be clearly and logically expressed, and will, on that account, be valuable to students. The volume contains a large number of tables, diagrams, and accumulated information.

The Naval Pocket Book. Edited by L. G. Carr Laughton. London: Thacker & Co., 1899.

The fourth issue of what is still fondly called "Laird Clowes' Pocket Book," though the founder is still obliged through continued ill-health to leave the care of his bantling to another hand, comes to us with exceptional interest this year. For one of the characteristics of the book (and one wherein it differs from and is very supplementary to Brassey's Naval Annual) is the completeness and thoroughness with which it deals with smaller and less fully equipped naval vessels. And, as our readers are likely to remember, much of the history of the recent Hispano-American war turns on the adventures of vessels which were not of themselves of any very great importance. Here, however, we find the need for some corrections and additions. At page 603, where is given the list of the American vessels subventioned for service as armed cruisers, we find the displacement of the *New York* and *Paris* given as 13,300 tons at 23 ft. draught. That of the *St. Louis* and *St. Paul* is given as 11,629 tons at 26 ft. draught. The latter are the bigger ships, and certainly when three ft. deeper in the water than the other pair would not be likely to displace 1,700 tons less. It is a pity, too, that the columns of the details of the auxiliary vessels at page 606, were not filled in. Most of the particulars referred to could have been easily extracted from Lloyd's Register of Shipping or the "Warships of the World." Both in this table and in the next gross tonnage seems to have been taken as a term convertible with displacement. Let us assure the editor that they are by no means synonymous expressions.

Again, at page 190 there is a table of old vessels lent for training purposes, &c. Many readers will turn thither in view of the recent destruction of H.M.S. *Clarence*, or to compare the table with that in Mr. C. McL.Hardy's recent book on "Boys for the Navy." The ship is there entered as a third-rate of 4,579 tons built in the year 1827. The reviewer believes, though he cannot be quite sure of this matter, that the entry in question refers to the old *Clarence*, the predecessor to the ship just burnt, in the duty of acting as reformatory ship. The *Clarence* of 1827 was an eighty-four gun ship originally. The ship just destroyed was built as a 120-gun ship, and was some forty years ago—when still under her original name of *Royal William*—one of a numerous lot of sailing line-of-battle ships, which were under orders to be adapted for the screw.

These little criticisms may be very trifling. At all events they do not affect the comparative strength of the fleets of the world. But it is right that they should be pointed out in order that, if possible, the minor tables should be rendered as accurate as the larger ones. For the latter we have nothing but praise. They seem to give the fullest and most recent information regarding all the navies of the world. No doubt, if Mr. Laughton were a candidate for Parliament, and on, what Sir George Willis thinks, the wrong side, our author might find himself branded with the Brassey family as divulgers of his country's secrets if the gallant general in question had sufficient knowledge to appreciate the thoroughness of its information. We have mentioned this point because we wish to protest most strongly against any such foolish idea. The work which the Brassey's (father and son) and the compiler of this little book have done in spreading accurate information as to the comparative strength of navies, has accomplished the task of enlightening the man in the street as to the power and duties of our maritime defences, and thus to make him willing and anxious to contribute his share to maintain our navy in its present high state of efficiency. The work is for public benefit and the public will not let itself be misguided by noisy dotards, but will welcome another issue of so useful a work of reference.

For want of space we are obliged to hold over our Patent List, &c.—Ed. M.E

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 26th to August 25th, 1899 :—

Alton, G. B., fleet engineer to the *Duke of Wellington*, additional, to date August 7th.

Bain, D. H. W., assistant engineer to the *Wallaroo*, for temporary service, to date August 2nd.

Barr, E., engineer to the *Revenge*, for the *Boxer*, to date September 15th.

Bartlett, E. E., probationary assistant engineer to the *Terrible*, to date August 7th.

Batchelor, H. R., chief engineer to the *Vivid*, for the *Magpie*, to date August 3rd.

Batchelor, H. R., engineer to the *Pembroke*, for the *Salmon*, to date August 4th.

Beckett, W. H., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Beckett, W. H., chief engineer to the *Wildfire*, as assistant to chief engineer at Sheerness Yard (for drawing office), to date July 15th.

Benn, E. P. St. J., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Bevan, W. J., fleet engineer to the *Duke of Wellington*, for the *Narcissus*, to date August 21st.

Bingham, P., engineer to the *Duke of Wellington*, for the *Teazer*, undated.

Blake, A. V., staff engineer to the *Duke of Wellington*, additional, as overseer at Barrow-in-Furness, to date July 6th.

Bone, H., engineer to the *Duke of Wellington*, for service at Portsmouth Dockyard, as second assistant to chief engineer, to date August 3rd.

Brown, A., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Bryan, C. B. (probationary), assistant engineer to the *Andromeda*, to date September 5th

Butland, J. T. C., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Charlton, F. J., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Chater, F. A., assistant engineer to the *Rupert*, to date August 19th

Cock, A. E., assistant engineer to the *Andromeda*, to date September 5th.

Cornish, E., staff engineer to the *Pembroke*, for the *Hawke*, to date August 2nd.

Damant, W. S. (probationary), assistant engineer to the *Hannibal*, to date August 14th.

Davies, W. A. J., chief engineer to the *Seagull*, undated.

Dixon, R. B., engineer to the *Pembroke*, for drawing office at Chatham Yard, to date August 3rd.

Ellis, J. H. W. H., staff engineer to the *President*, additional, for service in Comptroller's department at the Admiralty, to date July 6th.

Fletcher, G. H., assistant engineer (temporary) to the *Thunderer*, to date August 19th.

Garde, R. B., engineer to the *Pembroke*, for the *Angler*, to date August 21st.

Goodyear, R H., assistant engineer to the *Venus*, to date August 18th.

Guyer, F., assistant engineer, has been promoted to be acting engineer in her Majesty's fleet.

Hall, W. B , assistant engineer, has been promoted to be acting engineer in her Majesty's fleet.

Harding, C A., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Hardwick, W. W., chief engineer to the *Vivid*, for the *Leopard*, lent, undated.

Henwood, J. W., fleet engineer to the *Sanspareil*, tod ate August 21st.

Hobbs, P., engineer to the *Duke of Wellington*, for the *Electra*, to date August 21st.

Hyne, A. L., assistant engineer to the *Andromeda*, to date September 5th.

Kilroy, W. D. (probationary), assistant engineer to the *Andromeda*, to date September 5th.

Kimber, J. L., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Kirwin, J. J., assistant engineer to the *Niobe*, to date August 18th.

Lakeman, W. B., assistant engineer to the *Jupiter*, to date August 19th.

Loveridge, H. J., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Ludgate, W. G., chief engineer to the *Seagull*, undated.

Lumsden, W. G. G. P. (probationary), assistant engineer to the *Halcyon*, to date August 3rd.

Main, F., engineer to the *Victory*, for the *Flirt*, undated.

Maltby, P. D., engineer to the *Duke of Wellington*, for the *Canopus*, to date September 15th.

Martell, R. W., engineer to the *Vivid*, for the *Skate*, to date August 21st.

Maxwell, J., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

McDonald, W. N., assistant engineer (temporary) to the *Vernon*, to date September 15th.

Misselbrook, S. G., assistant probationary engineer to the *Repulse*, to date August 18th.

Morris, T., fleet engineer to the *Duke of Wellington*, for the *Camperdown*, undated.

Mountfield, J., engineer to the *President*, for service at Admiralty, to date August 3rd.

Moysey, W. H. S., engineer to the *Tyne*, to date August 18th.

Murray, William K., acting engineer to the *Raven*, to date August 22nd.

Nye, A. J., fleet engineer to the *Andromeda*, to date September 5th.

Page, G. H., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Paterson, J. A., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Paul, O. R., engineer to the *Vivid*, for the *Ferret*, to date August 18th.

Pendleton, F. R., assistant engineer to the *Tribune*, to date August 14th.

Reynolds, H. E. J., assistant engineer, has been promoted to be acting engineer in her Majesty's fleet.

Rock, H. E., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Rodet, E. W., engineer to the *Vivid*, for the *Speedwell*, to date July 25th.

Roome, G. W., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Roome, G. W., chief engineer to the *Vivid*, as second assistant to chief engineer at Devonport Dockyard.

Sagar, E. L., engineer to the *Duke of Wellington*, for the *Petrel*, to date August 22nd.

Sanders, J. S., assistant engineer to the *Vivid*, to date August 19th.

Sillince, W. P., assistant engineer to the *President*, for service at the Admiralty, to date August 3rd.

Smith, H. F., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Snook, V. E., engineer to the *Pembroke*, for the *Zebra*, to date August 9th.

Soper, E. P., assistant engineer to the *Trafalgar*, to date August 18th.

Sparrow, F. W., assistant probationary engineer to the *Howe*, to date August 18th.

Stearn, W. T., engineer to the *Centurion*, for the *Whiting*, to date August 21st.

Stocker, P., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Stokes, W., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Swinney, E., chief engineer to the *Vivid*, for the *Gipsy*, undated.

Taylor, O. J., staff engineer to the *Sphinx*, to date July 26th.

Thomson, J., assistant engineer, has been promoted to be acting engineer in her Majesty's fleet.

Ware, C. G., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Willoughby, J. T., chief engineer to the *Proserpine*, to date August 4th.

Wood, W. H., engineer to the *President*, for service at Admiralty, to date August 3rd.

H. Binko & Co.—We are informed that Mr. H. Binko, late managing director of Binko, Ridsdale & Co., Limited, has resumed his old-established business as electrical engineer and manufacturer at 34, Leadenhall Street, E.C., under the former style of H. Binko & Co.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE month of August, and especially its latter half, has been crowded with events of interest and importance connected with the shipbuilding and marine engineering industries on the Clyde. On the 16th the Allan Line twin-screw-steamer *Bavarian*, 10,200 tons, the largest and fastest of the fleet, and the largest vessel yet produced by her eminent builders, Messrs. W. Denny & Bros., Dumbarton, ran her official trials on the firth, the result being a speed of 17¾ knots as the mean of several runs with and against the tide on the measured mile. On the same date the twin-screw steamer *Kinfauns Castle*, built by the Fairfield Co. for the Castle Mail Packets Co.'s fleet of Cape liners, was also steaming about the firth, and on the 23rd the official trial trip took place. On the builders' trial of this vessel, which took place earlier, the mean speed attained on the measured mile and between the Cloch and Cumbrae Lights was 18 knots, with the engines developing 12,000 I.H.P. The *Kildonan Castle*, a sister vessel to the *Kinfauns*, was sent off the stocks at Fairfield on the 22nd. On the 23rd Messrs. Denny, Dumbarton, consigned to the water the twin-screw *Papaioa*, which they have built to the order of the New Zealand Shipping Co. for their frozen meat trade between New Zealand and the mother country. The vessel is to carry 8,000 tons of deadweight, all told, on a draught of 25½ ft. This vessel, it is of interest to state, is, like the *Kinfauns Castle*, the initial twin-screw-steamer of the fleet, the New Zealand Shipping Co. having gone in for the two screws as enhancing the safety of the ship, she being intended also to carry 40 first and 40 second-class passengers.

Other events of note which are casting their shadows before include the speed trials of the Royal Mail Liner *Tagus*, which is now in the final stage of outfit opposite the yard of her builders, Messrs. Robert Napier & Sons, Govan; the departure of H.M.'s. first-class cruiser *Hyacinth* from the fitting-out berth of her builders, the London and Glasgow Shipbuilding Co., Govan; the launch of a large 8,000-ton cargo-carrier from the yard of Messrs. A. & J. Inglis, Pointhouse, for the British India S.N. Co.; and the launch from Messrs. Stephen & Sons, of Linthouse, of the 10,000-ton *Tunisian* for the Allan Line, a duplicate for most part of the *Bavarian* above referred to.

Whilst outstanding events, such as the foregoing, sufficiently indicate the briskness with which work is progressing in the yards and engine shops of the Clyde, it is gratifying to be able to record that August has seen a distinct revival in the placing of new contracts. Altogether about 55,000 tons of new shipping have been booked, the lion's share of the work going to builders on the lower reaches of the river.

Messrs. Caird & Co., Greenock, who are seldom without tonnage in hand for the Peninsular and Oriental Co., have been instructed to proceed with a steamer of about 6,000 tons register intended for that company's cargo service. The new vessel, which will be 450 ft. long, will be similar in all essential respects to the *Assaye*, recently completed for the company.

Messrs. Russell & Co., of Kingston Yard, Port-Glasgow, who have as many as 12 berths, all of which are kept constantly occupied with large steamers, mainly of the cargo-carrying type, have booked orders for three steamers each 355 ft. long, and of 7,000 tons deadweight carrying capacity, which will be fitted up for the cattle trade. The machinery for these vessels, which are for Dutch owners, will be supplied by Messrs. Dunsmuir & Jackson, of Govan.

Messrs. Murdoch & Murray, shipbuilders, Port-Glasgow, who have been credited with receiving orders for as many as a dozen steamers for passenger and cargo service on the river Amazon, inform us that, whilst it is true some additional vessels have been ordered recently, the wholesale order above alluded to is misleading. The statement must have reference to a number of vessels which are already well under way in this yard.

Messrs. William Denny & Brothers, Dumbarton, are credited with having received from the Allan Line the order to build and engine a twin-screw-steamer of the same dimensions and tonnage as the *Bavarian*. She will be built of steel to the scantlings and under the special survey of the British Corporation Registry of Shipping, and will be supplied with triple-expansion twin-engines to give the vessel a good speed, by Messrs. Denny & Co., of Dumbarton Engine Works.

Messrs. Napier & Miller, of Yoker Shipbuilding Yard, have booked an order for a screw-steamer of about 5,000 tons, for Messrs. John Warrack & Co., Leith. The engines and boilers will be supplied by Messrs. Dunsmuir & Jackson, Govan.

Messrs. William Simons & Co., Renfrew, have received, from the Mersey Dock and Harbour Board instructions to supply three steam hopper barges, and in connection with the same order Messrs. Fleming & Ferguson, of Paisley, are to supply a powerful side ladder dredger, the total cost of all being £89,620.

The Clydebank Engineering and Shipbuilding Co., Limited, have contracted with the London and South-Western Railway Co. to build and engine a twin-screw passenger steamer to replace the *Stella*, recently lost. The vessel, which will present certain improvements upon the *Vera*, the latest addition to the company's fleet, is to have a speed on service of 19 knots, and to be delivered in April next.

The purchase of this great concern by Messrs. John Brown & Co., Limited, of Sheffield, has now been practically arranged, and a statement regarding the reconstituted directorate and other matters may shortly be expected. Rumour is presently busy with another probable fusion of shipbuilding and armour plate-making firms on the lines of the Clydebank Co. and John Brown & Co. The report is that the London and Glasgow Shipbuilding and Engineering Co., Limited, are at present negotiating with a Sheffield firm with a view to amalgamation. An interchange of views has already, it is said, taken place between parties, and it is believed that, as a result, the desired "combine" will eventually be accomplished.

Messrs. Kincaid & Co., Clyde Foundry, Greenock, have contracted to supply the engines and boilers for three of the passenger and cargo steamers for the river Amazon, recently ordered from Messrs. Murdoch & Murray, shipbuilders, Port-Glasgow, and have also received an order for engines of 800 H.P. for a cargo steamer for the Australian trade, which is to be built at the Foyle Shipyard, Londonderry.

Messrs. Ramage & Ferguson, Leith, have been commissioned by Mr. Harry M'Calmont, M.P., well-known as a sportsman, to build for him a new steam yacht, to replace the twin-screw yacht *Giralda*, which, it will be remembered, he sold to the Spanish Government during the war with the United States. This new vessel, which is to be ready for the spring, will be a twin-screw-steamer, 210 ft. in length, of over 800 tons Thames yacht measurement, and will be built to Lloyd's highest requirements, and have a high rate of speed.

The fact that those responsible have managed to dry-dock the American liner *Paris*, after her severe ordeal on the Manacles, at Milford Haven, and that the work of shoring her up for the purpose of repairing the damage to her hull has been accomplished, sets at rest the expectancy felt on the Clyde that the big vessel might be brought to that river for the necessary repairs, the owners and the Clydebank firm having, it appears, arranged that the latter shall execute all the work required. It is understood that the Clyde Trustees would not have been adverse to granting the use of one of their graving docks at Govan for this purpose, could the work have been executed in a reasonable time. In this connection it may be stated that Mr. James Deas, the Clyde Trust engineer, has had plans completed for some time for the lengthening of Nos. 1 and 2 graving docks. It is thought that a suitable opportunity for commencing operations is only being awaited to have the work put definitely in hand.

The work of sounding Glasgow Harbour for the purpose of ascertaining the various depths of water, which is done once in four years, and has been in progress for the past two months, is now completed, and the results are being compiled so as to form a chart for the guidance of the Clyde Trust in future dredging operations, and also for the guidance of mariners and others interested in the various depths of water in the channel. This applies to the harbour and that portion of the river and firth lying within the jurisdiction of the Clyde Trust, viz., down to a line stretching from Newark Castle, Port-Glasgow, on the south, to Cardross on the north bank of the river. The 1891 soundings were accepted by the Admiralty as official and still remain on their charts as such, the soundings below Newark Castle being those of the Clyde Lighthouses Trust, and those further down being taken by the Admiralty officials themselves. The soundings in the upper reaches were taken at intervals of 20 ft. across and 100 yards up and down the river, and in the lower reaches, of 20 ft. across and 200 yards up and down. Some work with reference to the set of currents, and the manner in which these carry the scour down from the harbour and deposit it in the quiet pools further down, has yet to be done with the object of finding out what portions of the waterway become shallow first and so require most dredging.

All-potent steam has rendered the presence of tall masts and spars on board ships all but superfluous. As a flagstaff no doubt, and as a standard on which to rig cargo derricks, the centre line mast still justifies itself, but in many broad modern cargo carriers with side cargo hatches and derricks, or side cranes to suit, the utility of still adhering to the central mast, even as a standard or pillar for supporting the ends of cargo derricks, seems almost questionable. The width of many modern vessels and their hatches, and the number of derricks to be carried, entail brackets which nearly embrace one-fourth of the beam. In view of such facts Captain Haynes, R.N.R., Glasgow, has devised an arrangement of derricks and winches by which he boldly dispenses with the central mast altogether, and a model illustrating his ideas was lately shown to shipping and other members interested on the Glasgow Royal Exchange.

Captain Haynes erects struts at the sides of the vessel and connects them by an overhead crossbeam and intermediate cross platform. The derricks to any number may be supported at any convenient intervals across the ship by this platform, and it also supports the winches about 8 or 10 ft. above the deck. This allows sufficient space underneath for cattle or cargo as required, and it keeps the winches out of the wash of the sea and permits the craneman, when cargo is being discharged, having a good view of the working process in the hold, and also of the goods as they are swung on the quay. When the derricks are all lowered when on a voyage at sea, the framework of this derrick and winch supporting arrangement can still be made available for unfurling sails if thought advisable, and there is at all times, of course, a dwarf mast over the centre of the framework serving as flag-pole and signal hoist. The arrangement is said to have found favour with gentlemen connected with Lloyd's and the British Corporation Registry of Shipping.

THE TYNE.

(From our own Correspondent.)

Shipbuilding.—The scarcity of enquiries for cargo steamers continues to be noted, and it is generally felt that as long as the present prohibitive prices rule, no improvement in demand is likely to occur. Very few orders are being placed just now, and such as are being successfully negotiated are in pretty nearly all cases, for vessels required for special services. There appears, however, to be some slight revival in the freight market, and the mooring places of the port continue to be happily free from the accumulation of laid-up tonnage which formed so prominent a feature a couple of years ago. These are healthy signs, and we may not after all be so near a collapse in shipbuilding as has been anticipated.

The bad practice of losing time unnecessarily, which is being indulged in to a ruinous extent by one section of shipbuilding operatives, has again been the subject of discussion between the employers and the representatives of the workmen. Nothing resulted from the discussion, however, beyond the declaration by the trade union representatives, that they would make further efforts to restrain their constituents from indulgence in the vicious habit referred to. It is not seriously expected that these "further efforts" will prove more effectual for the suppression of the evil than the efforts previously made; but the employers have evidently been desirous to give the union officials every possible chance, and to exhaust all conciliatory means for the bringing about of a more satisfactory state of things, before resorting to the somewhat drastic measure which is the true and only remedy for the evil complained of. This measure is simply to repudiate trade union interference in the setting on of men, and take it upon themselves to throw their yards open to all capable workmen whether members of a union or otherwise. It is trade union exclusiveness which has left the employers almost at the mercy of the drunkard and the loafer; for they have been forced to accept men of the latter stamp, who will just work long enough to provide the means of getting a good supply of their favourite liquid, and no more—as the trade union will not allow anyone to start work who is not a member. Things would be different if the employers had the power to set on whom they pleased. This is a power which rightfully belongs to them, and, however reluctant they may be to run counter to the views of the trade union officials, they *must* claim it and use it, before they can succeed in bringing about regularity of working in their yards.

In the absence of new orders for cargo boats, it is satisfactory to be able to state that some of the orders for specialities have found their way to the Tyne, Messrs. Armstrong, Whitworth & Co. having been commissioned to build two very powerful dredgers for service in the East Indian rivers, and one, of still larger dimensions, for Australia. Instead of the ladder and bucket arrangement, which is usually employed in dredgers, these vessels will be equipped with pumps of peculiar design, which will be effective in raising the muddy deposit that is the principal element to be dealt with in the deepening of Eastern waterways. The dredger for Australia, which is to be the largest, will, it is said, cost about £60,000, and the others, it is understood, will not be very far behind in the matter of costliness. All three will be fitted with watertube boilers, which, as well as a portion of the machinery, will also be constructed on the Tyne. These, it may be stated, are the first dredgers undertaken to be built on the Tyne for a period of 18 years, the last one turned out on the river having been the *Wear*, ordered by the River Wear Commissioners from the now extinct firm of Hawks, Crayshaw & Sons. Some few years earlier a dredger was built at Walker by another firm which has since ceased to exist; but on the whole it cannot be said that much has been done in this branch of work by Tyne builders, and it is a good augury for the future to see one of the foremost firms on the river giving their attention to this special line of business, in which they are sure to achieve success. Besides the icebreakers referred to last month, this company have several large oil-carrying steamers in progress at their Low Walker yard, and are extremely busy with battleship work at their Elswick establishment.

Messrs. Swan & Hunter continue to be extremely busy in the shipbuilding department; but it has not transpired that any orders have as yet been booked for the pontoon yard. It is understood that the great Cunard liner, which the firm are building in one of their covered berths, will be put off the stocks about the middle of this month (September), and preparations are already being made for the successful carrying out of the interesting function. The vessel, which is over 600 ft. long, is being equipped in a thoroughly up-to-date manner, and the date of her removal from the stocks to the water will undoubtedly be a red-letter day in connection with the industry of shipbuilding on the Tyne.

Messrs. Wigham, Richardson & Co. are amongst the firms that are well booked forward, and are sure to keep their briskness of trade intact during next year as well as this. There are now five vessels in progress, two of which are of exceptionally large dimensions, and it is understood that other vessels of an equally important class are in preparation.

One of the results of the change recently brought about in the constitution of the firm of Messrs. R. Stephenson & Co. is that no new work is likely to be entered upon at the shipbuilding yard for a period of twelve months or more. This is to give ample opportunity for the carrying out of the great scheme of alteration and extension that has been decided upon, and which is expected to place the firm—as far as productive capacity is concerned—in the first rank of shipbuilding firms. It will, of course, take some time to clear out the work in hand, but when that is got out of the way, the place will be quite unencumbered, and perfectly free for the prosecution of the changes contemplated.

The Palmer Co. have still an abundance of work on the stocks at their Jarrow yard, all the vessels (with the exception of the three torpedo boat destroyers) being of a large class. The splendid steamer *British Princess*, which has been built to the order of the British Shipowners' Co., Liverpool, is being fitted out at the shearlegs, and on account of her great size forms a very conspicuous object at that part of the river. The vessel is to carry 10,000 tons deadweight, and is fitted with exceptionally powerful machinery to drive her at a high rate of speed.

The whole of the other yards are still kept going briskly, including the smaller establishments at the mouth of the river, which are well supplied, with orders for fishing vessels. Premises are being erected at North Shields—and are now a good way advanced—in which the building and engining of small vessels is to be undertaken, and probably repair work also. The premises are in a good situation, and it is fully expected that the enterprise will be a success. The graving docks and slipways of the Tyne are nearly all occupied with vessels undergone painting or repairs.

Engineering.—In all the marine establishments a high state of activity is maintained, and in every instance there is at least one vessel being fitted with her equipment of propelling machinery. The Wallsend Slipway Co. have some important repair contracts in hand, in addition to the new work, and all the departments will be kept at racing speed during the autumn and winter months.

At the North-Eastern Engineering Co.'s works business is also extremely active, and if appearances are to be relied upon, it will be long before any change for the worse is apparent. The reports respecting a trial trip of a steamer built in Italy, but fitted with this company's engines, are of the most flattering kind, the speed attained on a particularly low fuel consumption being in the highest degree satisfactory.

At Messrs. R. Stephenson & Co.'s South Street Works business is very brisk in both the locomotive and marine departments. The trial of the s.s. *Garonne*, built and engined by the firm for the United Steamship Co., Copenhagen, took place on the 14th ult., and was in every way a marked success. This vessel is fitted with Cedervall's lubricating protective box, which arrangement, whilst excluding sea-water from the propeller shaft, keeps the latter constantly running in oil, with the result that no corrosion, nor fracture can take place. Special note was taken of the effects produced by this apparatus on the trial trip, and experts on board declared that the smooth and perfectly satisfactory performance of the machinery was largely attributable to the presence of the box. The feature of the trial was the almost complete absence of vibration, a result which would have been practically impossible but for the smooth working of the propeller shaft, caused by the presence of the lubricating arrangement mentioned. The trial of another vessel—the *Staunton*—engined at the North-Eastern Works, Sunderland, which took place early in the month, showed equally good results, this vessel having been fitted with Cedervall's box, also.

The extensions at the Blaydon Forge Co.'s works, which have been in progress for several months, are now approaching completion, and the new machinery, which is of the most effective kind obtainable, is being placed in position. With the new arrangements, and the very considerable additional space provided, the company will be able to undertake and execute work of a much more important class than they have hitherto been able to deal with. The company have achieved a good reputation for the soundness of their productions, and we feel sure there will be little likelihood of their forfeiting this in the larger sphere of operations upon which they are now entering.

Messrs. Proctor & Son, iron merchants and manufacturers of steamship accessories, have recently booked some important orders for ventilators and other appliances, and are obliged to work double shift to keep pace with requirements. The firm's workshops at Gateshead are being enlarged with a view to meeting the necessities of the situation, and it is expected that the additional space and the additional machinery provided will soon be available for carrying on the firm's business at a greatly accelerated rate of production.

Owing to the unsuitableness of the premises for his largely developed business, Mr. W. F. Snowdon, asbestos manufacturer, &c., has had to leave No. 2, The Side, and remove to premises on the first floor of No. 32, in the same street. The occupation of these premises will probably only be temporary, or till such time as sufficiently spacious ground-floor premises are obtainable.

The Zynkara Co. are still experiencing a large demand for their speciality, and at the place of manufacture considerable activity prevails.

In the iron foundries business continues active, and brass foundries are not in the smallest degree less busy. The smaller engineering establishments are, generally speaking, doing well.

THE WEAR.

(*From our own Correspondent.*)

Shipbuilding.—Messrs. Pickersgill & Sons have booked an order for a good-sized vessel during the month, and this is the only order that has been heard of.

Messrs. W. Doxford & Sons launched on the 22nd ult. the fine "turret" ship *Clan Urquhart*, which is the 10th vessel built by this firm for the owners of the Clan Line. Four of these vessels, including the *Clan Urquhart*, have been of the larger type, measuring (each) 440 ft. in length, the remainder being of the smaller type, or not more than 400 ft. in length. We are informed that the firm have six others to build for the Clan Line, and the 16 vessels—when all are completed—will assuredly constitute a pretty large fleet of themselves.

Messrs. Short Brothers are now perhaps in a better position than they have ever been as regards the supply of workmen, and particularly of riveters. Three months ago the officials of the Boilermakers' Society, after vainly beseeching the firm to come under their yoke, succeeded in inducing the greater number of the riveters to abandon Short's yard, ostensibly with a view of being incorporated with the Boilermakers' union. Now a large proportion of these men (the pick of them) have returned, and in addition the firm have been enabled to train a number of young operatives—shipwrights and others—into entirely capable riveters. Whilst other firms have been begging the Boilermakers' executive to supply men, Messrs. Short Brothers have been supplying themselves; and the result is that there is no yard on the Wear where at this moment there is so little stoppage of work on account of the backwardness of the riveting.

Messrs. J. L. Thompson & Sons continue extremely busy, and at all the other yards work is still abundant. Some five vessels, aggregating about 25,000 tons capacity, have been launched on the Wear in August, and it is quite probable that as many will be put off the stocks in September.

Engineering.—Messrs. John Dickinson & Sons (Palmer's Hill Works) are still extremely busy in all departments, there being some repair contracts in hand, in addition to the new work. Messrs. George Clark, Limited, are engining a handsomely modelled vessel, just launched by Messrs. Short Brothers, and Messrs. Doxford are also fitting with machinery a new vessel.

The electrical department of the Sunderland Forge and Engineering Co.'s Works has just received a very large accession of work, and the pattern-shop is extremely busy, indicating a plentiful supply of work for other departments in the future. Among the contracts recently secured is the lighting of a large hotel at Gilsland. This installation is belt-driven, and includes boiler, engine, and dynamo. The two latter are combined on the principle adapted so successfully at these works. The company have also a contract from the Easington Coal Co., Limited, to supply an installation of arc and incandescent lamps for surface lighting at the colliery. The installation will include a "Pallion" dynamo and engine combined. The company have recently begun to manufacture, as a speciality, a circular saw bench with an electric motor attached, by which the saw is driven. This arrangement is particularly well suited for application on shipboard, as the machine can be fitted either on deck or in one of the holds. It is needless to observe that in discharging timber-laden vessels a large amount of time and labour may be saved by cutting on board such portions of the cargo as may be too large for easy handling. This speciality has already achieved a fair measure of popularity, and orders for it are increasing in number daily. The company have just completed a large lighting and power installation in a shipbuilding yard on the Wear, and are commencing a similar contract in another local establishment of the same kind. They have also just finished the last of four installations of 80 lights each (with engine and dynamo combined) in four vessels built by Messrs. Short Brothers for the Southern Steam Shipping Co., and have now several lighting installations in hand for vessels building on the Tyne and on the Wear.

In the forging department orders are also plentiful, stern frames and rudders being the articles most in evidence. The company are now making a special type of balanced single plate built rudders, which is attracting much attention. The introduction of the balancing principle in merchant ship rudders is undoubtedly a great step in advance, and the Sunderland Forge Co. are to be congratulated on their enterprise in initiating the improvement. One of these balanced rudders has been fitted to the s.s. *Clan Urquhart*, and another is now ready for the ship to be launched by Messrs. Doxford.

Ironfounders continue to be well supplied with orders, and both brass and copper works are busy. At the Monkwearmouth Ironworks business is good, the demand for the special patent sections, manufactured at this establishment, being rather on the increase. The Rectory Engine Works (Messrs. Wilcox Brothers), are doing a steady trade.

The Hartlepools.—Shipbuilding at this centre maintains the high degree of briskness noted on previous occasions, and notwithstanding the dearth of orders in other districts, it is understood that new business of importance has been successfully negotiated by builders at this port. Sir W. Gray & Co. have obtained the contract for repairs to the large oil steamer *Clam*, which was stranded on the coast of Algeria while on a voyage from North Shields to Batoum. The vessel, which belongs to Messrs. Samuel & Co., is very badly damaged, and will have, to a large extent, to be reconstructed. The work of repair and alteration will, it is expected, occupy about three months. It is stated that Messrs. Gray have also booked an order for a new vessel of good size, from Messrs. Ruthven & Co., of Cardiff. The marine engine works continue busy, and in Messrs. Richardson's electrical department there are several important orders on hand. Work at the docks is now quite brisk, the timber-importing trade being in full swing

Stockton.—There is no change in the state of work at the shipbuilding yards, and marine engine works continue as busy as ever. Boiler shops and bridge works are full of orders, and in the former establishments some difficulty is experienced in giving delivery in accordance with contract requirements. Steel manufacturers have more work than they can deal with, and are in many cases unable to give delivery by specified dates.

Middlesbrough.—The leading shipyard at this centre continues busy, and other establishments are showing scarcely less activity. Steelworks are exceedingly busy and prices are firm, the rate for ship plates being £7 12s. 6d. per ton, and for boiler plates £8 15s. per ton, less 2½ per cent. Steel ship angles are £7 5s. per ton, and iron ship angles £7 per ton.

Engineering works continue to show activity, and local foundries are still extremely busy. At the docks there is now considerable stir, the largeness of the timber imports contributing materially to the general activity that it is to be noticed.

Seaham Harbour.—The great scheme of improvement in the dock accommodation at Seaham Harbour, which has been initiated by the Marquis of Londonderry, is already on the way towards fruition, as work at several points, including the formation of two piers, has been commenced. An idea of the changes proposed to be effected may be formed from the circumstance that the water area of the docks is to be increased from 2½ acres to 10 acres. The capacity of the port at present is to admit vessels up to 1,000 tons only; but it is estimated that when the work of alteration is completed, there will be accommodation for vessels up to 5,000 tons. The contractors for this great work are Messrs. S. Pearson & Sons, Limited, London, and Mr. T. L. Walsh has control of the work on the spot.

THE MERSEY.

(From our own Correspondent.)

ALTHOUGH generally throughout the engineering branches of industry activity is fully maintained, and there are very few works that have not sufficient orders to keep them employed, at any rate during the remainder of the year, and in some cases well into next year, there is unquestionably a slackening off in the weight of new work now coming forward to replace orders as they run out, and consequently the outlook for the future is not quite so satisfactory as it has been. Establishments employed specially on marine engineering have generally a large amount of work on hand, and as this is necessarily of a heavy character, several of the principal establishments in this district have their books full for twelve months ahead, but in other branches of machine tools there is some falling off as regards work giving out. The same remark applies also to heavy stationary engine builders and to locomotive builders—some of whom are anticipating a very slack period—whilst in the textile machinery trade the establishments are rapidly running out their orders with comparatively very little new work coming forward. Electrical engineers are, however, not feeling any slackening off, as the very large developments in this branch are sufficient to ensure them a large amount of work for some time forward.

The returns of the principal trade unions show no falling off as far as present employment is concerned. The Amalgamated Society of Engineers has now less than 2½ per cent. of its total members on donation, with about the same proportion in this immediate district, and a good demand for pattern makers and tool fitters. The Steam-Engine Makers' unemployed list remains at about one per cent. throughout the organisation, with a "clear book" in the Lancashire district. The United Machine Workers' Association has not more than two per cent. on donation either generally or in the Lancashire district. Reports as to the state of trade are mostly of a favourable character.

With regard to the wages question in Mid-Lancashire an agreement has been come to whereby the employers grant an increase of 1s. per week until the question of whether the state of trade at the end of June was as good as at the beginning of April has been decided by an independent person. If the umpire decides that the state of trade at the end of June was as good as at the beginning of April, the arrears of pay from the first pay day in July until the commencement of the advance now granted are to be paid, and the advance now granted will be continued till further notice. If the umpire decides to the contrary the advance now granted will cease, as and from the first full pay three months after the date of the agreement, but the men are not to be called upon to return any money they have received. It may be added that Lord James of Hereford has consented to undertake the duty of umpire.

Messrs. Laird Brothers, of Birkenhead, report that there is nothing special to note this month, beyond the fact that the new fast paddle steamer, *Mabel Grace*, built to the order of the South Eastern Railway Co., has made a very satisfactory preliminary trial, and will undergo her official trial in the course of the next fortnight. It may be added that on the Liverpool side of the Mersey the shipbuilding industry, which for years past has been steadily on the decline, has now practically received its final *quietus*, the few remaining yards being required for the Dock Board extensions, and as a result the last of this at one time important section of the shipbuilding industry on the Mersey will shortly altogether disappear.

In addition to the numerous new undertakings referred to last month, which are in progress in connection with various descriptions of works in close proximity to the Manchester Ship Canal, there are further important developments contemplated, amongst them being the establishment of a very large steelworks, whilst a number of other industrial establishments are also in progress in the immediate vicinity. The Ship Canal Co. are also laying themselves out to provide for the increasing traffic which is coming forward, and are largely increasing their wharfage capacity by deepening the waterway along the Old Trafford section, and constructing a new landing way, which will provide considerably increased accommodation for certain classes of traffic.

Messrs. Isaac Storey & Sons, of the Empress Foundry, Manchester, have recently considerably enlarged their works, and have included in the rearrangement the adoption of electric driving throughout. There are two main dynamoes of 200 amperes each, and a total of 230 volts, both being driven from one counter-shaft with clutches, so that they can be used either separately or simultaneously. The engine is of the Proell-Corless type, made of the firm, of 100 H.P. There is also to be put down a direct coupled plant of about 100 amperes, and the same voltage, for office lighting, and to meet the needs of overtime working in a small section of the establishment. The boiler is of the Lancashire type, by Messrs Beeley, and a Green's economiser, and independent condensing plant are also provided. The main shop is 120 ft. by 80 ft., with galleries 120 ft. by 20 ft, the erecting floor being served by a Vaughan 10-ton electric crane. The galleries are used for brass finishing requirements. Other sections of the works include the coppersmith's shop, 140 ft. by 80 ft.; brass foundry, pattern shops and stores, testing rooms, &c. It may be mentioned that the firm have recently completed a number of surface condensers for torpedo destroyers for the Japanese Government, and have also turned out two sets for the new turbine type of destroyers. They make a specially heavy type for land requirements, which in some cases has as much as 4,000 square ft. of condensing surface.

Messrs. De Bergue & Co., of Manchester, have in hand for the Salford Corporation a special portable riveting plant for riveting the joints of the new electric tramways to be laid down in the borough. This plant will be mounted on a four-wheeled trolley carrying a steam boiler, air-receiver, air-compressor, and a small swing jib crane for carrying the pneumatic riveter. The trolley is self-propelling, being driven by steam from the boiler, and the rivets are heated by a travelling oil furnace running behind the main trolley, and supplied with compressed air by a flexible tube attached to the air-receiver. The apparatus will also include a pneumatic drill and a portable emery grinder, driven in the same way, for levelling off the butting joints of the rails after riveting.

Messrs. E. Goossens, Pope & Co., South Castle Street, Liverpool, are introducing a new design in incandescent electric lamps. In this new pattern the filament is all in one length, which enables it to be subjected to extra "treatment" by a new process which the firm have devised, the result being that the initial candle power of the lamp is maintained for a much longer period, with economy of current. The lamp is also fitted with a patent cap, which is fixed by means of a metal ring, and which dispenses with the use of plaster, so that it is proof against damp. This feature of the lamp renders it particularly suited for use on ships, where it will be found a sure protection against short circuits, waste or loss of current, and other defects to which caps in which plaster is used are liable.

During the past month not only has the upward move in pig-iron prices been checked, but there has been a substantial giving way on late rates in the open market. This is largely due to the big drop in warrants, which has caused considerable unsettlement in the market, and has given an irregularity to prices which has rendered it almost impossible to estimate actual market values. Buying has also been checked, and even at the lower prices at which iron has been offered, very few sales of any weight have been effected. Towards the close of the month there are, however, signs of returning confidence, and some recovery in prices may possibly take place before long. Local makers still ask nominally about 77s. 6d. less 2½ for No. 3 foundry, delivered Manchester, but they are practically out of the market. Lincolnshire makers have receded from the special quotations they were quoting a month ago, and have fallen back to their basis rates of 73s. 6d. for foundry, net, delivered Manchester, and 72s. 2d. forge, net, delivered Warrington, but merchants have been offering at considerably under than these figures. Derbyshire foundry is nominally about 75s. net, delivered Manchester. For Middlesbrough and Scotch iron prices vary considerably according to the different ideas of sellers. For Middlesbrough prices are now about 74s. 4d. to 76s. 4d. net, by rail Manchester. In Scotch iron there have been sellers at 76s. to 77s. net, Manchester Docks, but with the close there is a hardening up of 2s. to 2s. 6d on these figures. American pig-iron, has shown a further advance, and is quoted 75s. 6d. net, for October delivery at the Manchester Docks.

Finished iron is in active demand, both for the home and shipping accounts. Local makers are mostly fully booked in bars for some months ahead and could readily sell further considerable quantities at their full list of £8 5s. Occasional small sales have been made at £8 10s., but it can scarcely be said that this is a figure which makers are able to get in the open market even for forward delivery. Makers, however, are disinclined to commit themselves at all far ahead. North Staffordshire bars are firm at £8 10s. with £8 15s. got in some cases for forward delivery. Hoop makers are exceedingly busy, with list rates firm at £8 12s. 6d. for random, to £8 17s. 6d. for special cut lengths, delivered Manchester district, and 2s. 6d. less for shipment. Sheets are steady at £9 10s. to £9 15s.

In the steel trade business is active except perhaps for raw material, which has been affected by the fall in warrants. Hematite makers, however, still quote 87s. 6d. to 88s. 6d. less 2½ for No. 3 foundry delivered Manchester Local billets are about £6 5s., and steel bars £7 15s. and £7 17s. 6d. for local, to £8 and £8 7s. 6d. for special makes. Steel boiler plates have advanced about 10s., and are now quoted £9 10s. to £9 12s. 6d. Hoops are strong at £9, and a noticeable feature is that considerable American enquiries are just now in the market. In wire rods also fairly large enquiries from America and Canada are being received, and considerable orders have already been booked; delivered f.o.b. Liverpool. Lancashire makers are asking £9 5s. per ton.

The metal market continues active, and prices are strong, but there is still no quotable change in list rates, which delivered Manchester district, remain as under:—Solid drawn brass boiler tubes, 9d.; condenser tubes, 10½d.; copper tubes, 11½d; brazed copper gas and steam tubes, 11¼d.; brazed brass tubes, 10d. common rolled brass, 8¾d.; and common brass wire, 8½d.; and copper wire, 10¼ per lb.

Business is fairly active in the timber trade. The arrivals generally have not exceeded the requirements of the trade, and as deliveries have been satisfactory, stocks, with few exceptions (notably, pine deals), are of moderate compass, and values of most articles are steady. The import of teak squares has been small, and there is a fair demand, with prices firm; stocks are moderate. Teak planks have arrived freely, but continue in fair request, at steady rates; stocks, however, are increasing. Only one cargo of greenheart has arrived, but stocks are too heavy and prices easier.

The coal trade maintains an exceptionally satisfactory position for the time of the year. Housefire coals are necessarily meeting with only a very limited sale, and stocks are accumulating, but as these are still below the average, prices are being well maintained at about 11s. 6d. to 12s. 6d. best Wigan Arley; 10s. to 11s. Pemberton four-foot and seconds Arley; 9s. to 9s. 6d. common housecoal. Steam and forge coals move away freely at fully late rates, averaging 8s. 9d. to 9s. at the pit's-mouth. Supplies of engine fuel are becoming increasingly scarce, and there has during the month been an official advance in prices of 5d. per ton, making a total advance of 2s. 6d. over last year's prices. At the pit's mouth best slack is now 7s. to 7s. 6d., medium 6s. to 6s. 6d., common sorts 5s. to 5s. 6d. per ton.

Shipping is fairly active, with prices averaging about 9s. 6d. to 10s. delivered Garston Docks, near High Level, Liverpool.

The demand for coke is in excess of the output, and prices are exceedingly strong, 17s. to 19s. for furnace qualities and 26s. to 27s. for foundry cokes being quoted at the ovens.

THAMES.

(*From our own Correspondent.*)

Werner, Pfleiderer & Perkins, Ltd.—The paper which Mr. Loftus Perkins read before the United Service Institution on his system of boilers and engines is an important one, since it shows the progress of an engineer in his attempt to make his system perfect. Mr. Thornycroft and Mr. Yarrow have gone through the same ordeal, with the results which we see to-day in the almost perfect systems of steam-using in the torpedo-destroyers. Mr. Perkins had first to get his engines right. We are told that no end of trouble was experienced with the piston rings. It appears that this trouble with the piston rings had first to be tackled by him in the engines of a client in the country where high-pressure steam was used. The rings used continually broke down, and before they did so scored the cylinder. So Mr. Perkins had to settle down and think the problem out. The result was the invention of a metal which was brittle and at the same time wore away into a fine powder. No lubricant was required. It has been tried in the fastest torpedo-boat-destroyers by Mr. Thornycroft with uniform success. Mr. Thornycroft says: "It is a splendid material for piston rings, as there is no chance of the cylinders being scored when it is in use; we supplied it for the piston rings of the torpedo vessels we delivered lately to the French Government, and found we could run the two hours' trial easily at the rate of about 430 revolutions per minute, and without using any oil or grease in the cylinders." Mr. Donaldson, Mr. Thornycroft's partner, said, in the discussion of the trials: "In the preliminary runs we had a great deal of difficulty from priming, finding it impossible sometimes to run even for an hour without trouble in that way. At last, believing that our difficulties arose from the use of oil in the cylinder as a lubricant, which, accumulating in the condenser and pipes, was pumped thence into the boiler, I resolved, as the pistons were fitted with rings of Perkins's metal, to abandon the use of oil altogether, and to run the engines dry; so I had the condenser and boiler cleaned out with caustic potash and then had perfectly pure water pumped in. The result was that we found we could run the boat continuously for two hours without the slightest fear of priming. . . . If Mr. Perkins, by the use of his patent metal, has got over the necessity of using oil in the cylinder of surface-condensing engines, and I believe he has, he will, in my opinion, have added greatly to the life of modern marine boilers." In the year of his reading the paper, 1877, the pressure of steam in the boilers was 300 lbs. The initial pressure shown by the indicator diagram was 268·7, the terminal pressure in the high-pressure cylinder was 150·7, and the mean pressure 167·4 lbs. In the intermediate cylinder the initial pressure was 89·7 lbs and mean pressure 32·5 lbs. In the low-pressure cylinder the mean pressure was 12·2 lbs. Diameter of cylinders: high-pressure 15 in., intermediate 30 in., and low-pressure 60 in. It was stated that the evaporation in the boiler was 10·4 lbs. of water per lb. of fuel, and the consumption of coal one lb. per I.H.P. The rings for the high-pressure cylinders of destroyers are in use to-day.

Mr. C. H. Bryant, of Chiswick, has made an oil motor, and it has been fitted into a launch which runs occasionally on the Thames. Mr. Bryant claims for it that the oil engine can run after it has been once started without any lamp or hot tube to ignite the mixture and obtain the explosion. The heat of the combustion chamber serves to produce ignition. This is not anything new, since the Hornsby-Acroyd engine has done this for years, and there are other engines which do the same. The air charge is divided as it comes in: one portion of it takes up a charge of oil, whilst the other portion goes right down into the cylinder. The Hornsby engine also does this. The engine does not govern well. It governs by cutting a charge right out. There are three cylinders with the pistons connected to cranks at 120° to each other.

Pimbley Patent Forced Circulation Economiser.—This is an ingenious economiser, which consists of a number of pipes of U shape, bolted at the top to a long cast-iron box, and passages are formed in the iron box for the water to pass from one pipe to another. The water enters the economiser at the top box and flows down the first half of the first pipe and up the other half, then through the thoroughfare of the top box to the first half of the second pipe, and so on to the end of the pipes. The pipes are each fitted with a bonnet at the bottom to facilitate cleaning, and also fitted with scrapers worked by rods from a beam coupled to a face-plate crank; the rotary motion of the latter dispenses with the old jack reversing motion. The whole is of thoroughly sound construction. The pipes have three square inches of heating surface to each cubic inch they contain. There are no bottom boxes, because all the pipes hang from the top cast-iron box, and this allows the pipes to expand and contract with perfect freedom.

Joseph Wright & Co., of Tipton and Victoria Street, Westminster, have a very successful feed-heater; no less than 7,000 of them have already been fitted into land and marine steam plants. The construction is very simple. There is a cylindrical vertical vessel, at the bottom of which is a tube plate bevelled upwards from the middle on both sides. Pipes are expanded into the tube plate and go up inside the chamber, bend over at the top, come down, and are expanded into the tube plate on the other side. There is a division plate up the middle of the chamber which reaches up to the bends of the pipes. Water is allowed to enter at the bottom of the chamber above the tube plate, and it rises slowly to the top, where it flows away by the outlet. The time the water takes to reach the top is about half an hour. By allowing it to rise slowly it has time to allow the sediment and salts to fall to the bottom, whence it is removed by a sludge valve. The bevelled tube plate allows the tubes to be all of one length, and so the steam which flows through them is equally distributed throughout the tubes. Instead of being placed vertically, like the feed-heater, the surface-condenser made by this firm is placed horizontally. The tube plate is bevelled on each side of the middle plate, and the water in this instance flows through the tubes. The water flows in by a branch at the top, runs through the tubes and out by a branch at the bottom. Steam flows in at a branch at the top, circulates round the water surface of the tubes, and flows out by a branch pipe at the bottom. These condensing plants are made of very high H.P. capacity.

J. I. Thornycroft & Co.—This firm is much to the front at present as the builders of the yacht on which the hopes of England are concentrated for the bearing of the flag in the coming international race. The *Shamrock* made a record passage between this country and America. She was allowed three weeks to make the voyage, and she did it in two weeks. Sir Thomas Lipton, the owner, sent his steam yacht *Erin* along with her, and it was the condition of the challenge that she should sail across the Atlantic, and only be assisted in towing when there was calm. The conditions were kept, and she did the journey in a fortnight. It will not be the first time that the country will have been indebted to the enterprise of the firm for making record speeds by means of new and improved machinery. When lecturing on "Steam Speeds at Sea," Sir Nathaniel Burnaby said: "Out of the four great steps in speed-making which would make the last quarter of a century for ever illustrious, Mr. Thornycroft must be credited with three, and an electrical engineer, the Hon. Charles Parsons, with the last. Mr. Thornycroft, in his several successes, has given us a new form of boat, a new system of construction, a new form of propeller, and an effective way of generating steam by methods which had been often tried unsuccessfully and abandoned."

BELFAST.

(From our own Correspondent.)

THE great event of the past month has been the finishing and opening up for inspection of the *Oceanic*, which at present lies at the Victoria Wharf. Saturday, the 19th August, was the date fixed for the public inspection, and, as was naturally to be expected, many thousands availed themselves of the opportunity of becoming more intimately acquainted with the magnificent vessel, whose praise has been in every newspaper, and whose name has become so familiar all over the world. The arrangements made were of the most complete character, and were carried out in a manner which contributed to the comfort and satisfaction of everyone. Two classes of tickets were issued, the high-priced ones admitting at any time between the hours of 11 a.m. and 6 p.m., and the others only being available from 3 p.m. to 6 p.m., the money obtained from the sale of these tickets going to swell the funds of the Royal Victoria Hospital. A certain route throughout the vessel was marked out, from which it was impossible to deviate, and officers and members of the crew were stationed here and there to impart information or give guidance to those who needed it. Flags streamed from mast to mast and floated at bow and stern; the Union Jack, the Stars and Stripes, and the White Star Co.'s pennant all having a prominent place, and, as fine weather favoured the occasion, the steamer looked her best. The visitors went on board the liner by a special gangway at No. 2 hatch at the fore end, which landed them on the upper deck at the starboard side, thus allowing them to inspect first of all part of the accommodation provided for third-class passengers, and it was pleasing to find that careful attention has been given to the needs of this section of the travelling public. Ascending again to the upper deck, the visitors passed into the forecastle, where they were permitted to examine the powerful windlass and warping gear, specially designed and constructed for this vessel. They then walked along the port side, going up the stairway to the forecastle deck, and after viewing this they went along to the promenade deck on the starboard side and up the captain's private staircase to the boat-deck, where the boats and fan casings were inspected. After proceeding as far aft as the engine room skylight on the starboard side, they returned on the port side, and went up the captain's bridge, charthouse, and wheelhouse. They then descended to the promenade deck, and walked along the port side as far as the second-class smoking room and library, and then to the poop deck, which is specially arranged for the comfort of second-class passengers. From this the visitors sauntered along the starboard side of the promenade deck, entering the main saloon entrance, where they inspected the staterooms and library situated on this deck. They then went down the grand staircase to the upper deck, and had an opportunity of inspecting the first-class cabins and smoking-room, after which they descended to the saloon deck, proceeding thence along the starboard side to the grand saloon, where the decorations and upholstery were examined, and also the magnificent dome with its elaborate ornamentation representing England, America, Liverpool, and New York, all of which is of special interest, the whole of the work having been designed and erected at an enormous cost; but this magnificent saloon must be seen to be thoroughly appreciated, as it would be almost impossible to give a detailed description of it. All that one can say is that in beauty of design and in excellence of workmanship it leaves nothing to be desired. Coming from the saloon they continued the inspection of the first-class staterooms, afterwards going down to the main deck, where the cabins, bathrooms, and lavatories were seen. Proceeding up the staircase at the after-end of this deck, the first-class pantry on saloon deck was reached.

Passing from this through the galley, sculleries, bakers' shops, butchers' shops, refrigerating chamber, and second-class pantry, the visitors entered the second saloon, which is very handsomely decorated and surmounted by a very fine skylight with richly painted glass of floral design. From this they proceeded along the port and starboard sides for the inspection of the second-class staterooms, thence ascending the second-class staircase and arriving on the upper deck, where the visitors had an opportunity of examining the arrangements for steering the ship and the heavy warping gear, which is in duplicate, specially designed for moving the vessel in docks when the engines cannot be used. The ship can be steered by electricity or by steam or by hand, and should any accident or circumstance render one method impracticable, another can speedily and easily be adopted. Progress was next made along the port side of the upper deck to the engine-room entrance, and permission was freely given to any person wishing to do so to descend to the port engine-room by the spiral staircase and make an inspection of the engines and boiler-room, and then pass through the watertight door in the division bulkhead which divides the two engine-rooms. The space allotted to the engines is unusually great, but not greater than one would expect when the immense size of the vessel is taken into account. There are 15 boilers—12 double and three single-ended—of about 1,000 tons total weight, and there are nearly a hundred furnaces. The engines are triple, four-cylinder, four-crank balanced, of about 28,000 I.H.P., and they drive two three-bladed propellers, placed very close together, with an opening between them. The port and starboard engines are divided by means of a watertight bulkhead, and it may be of interest to state that between seven and eight thousand tons of coal will be consumed in a round voyage from Liverpool to New York and back. From the engine-room the visitors returned to the spiral staircase on the starboard side of the upper deck, and having thus completed their inspection of the gigantic vessel, which, it should be stated, is lighted throughout by electricity, made their departure by a gangway placed at this point. The *Oceanic*, which is commanded by Captain Cameron, proceeded down the lough on the 24th ult. for her trial trip and adjustment of compasses, and for this purpose the river was kept clear for two or three hours. Two days afterwards she left Belfast for Liverpool, where she went into graving dock in order that certain final preparations for the first voyage across the Atlantic might be made. This work would have been done in Belfast but for the fact that another large steamer, the *China*, is at present occupying the graving dock here. On Wednesday, 6th September, the *Oceanic*, it is expected, will sail from the Mersey on her maiden trip to America, and she will have on board Mr. and Mrs. Ismay and a distinguished party, in addition to a full complement of passengers, every berth—first, second, and third class—having been booked some time ago.

Another of the White Star Line, the s.s. *Afric*, left the port on the 22nd ult., after having been in the hands of the builders, Messrs. Harland & Wolff, for some little time, in order to have refrigerating machinery fitted, and some other alterations carried out.

No launches have taken place during the past month, but we hope to have one to report from Messrs. Workman, Clark & Co.'s yard next month.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—The shipbuilding industry of this district remains very fully and busily employed, and, after the suspension of operations at Bank Holiday, regularity of work has been maintained; but the suspension was not general, and in many departments where workmen could be got to work through the holidays they were pressed to do so, in order to push forward some of the more urgent work in hand. There is no report of any new orders received during the month. Doubtless builders are quite busy enough on the contracts they have now in hand without attempting anything further at present, but some very good orders are in the market, and these are being tendered for, in order that some of the vacant slips in the Naval Construction Works may be utilised. There are only five berths occupied at present, and there is room for at any rate six more ships, although those now in hand require practically all the attention the capacity of the yard is capable of. These five berths are utilised for the three first-class cruisers for the Admiralty and one torpedo-boat destroyer, together with the Japanese battleship. It will readily be seen that these ships represent a very great deal of work, especially as very little start has been made with some of them; but it is almost certain that before the end of the year some of the other berths will be occupied with other craft.

There is a good demand for additional workmen in almost every department of local shipbuilding, but the difficulty in getting them is accentuated by the fact that when they come here they cannot get houses to live in. Barrow is completely congested as far as population is concerned, and all the efforts made to meet the difficulty seem, up to the present, to be inadequate. Here is an instance which came before the Barrow magistrates on August 21st:—An application was made for an order of ejectment against a man who had not complied with a notice requiring him to give up possession of a house now occupied by him. Defendant's wife appeared, and in a broken voice explained that they had been in the house four years. Now they had to leave, and, try as she herself and her husband would, it was impossible to get a house in any part of the town. They had a family of seven children, and when they went to secure apartments they were refused them on the ground that the family was too large. The magistrates said they must make the order, and advised the woman to do the best she could to get a house within three weeks. The fact is that where houses are to sell within easy reach of the shipyard, men are found ready to buy them, although prices are considered very high. When the tenants have to turn out and seek new houses or leave the district, many of them take the latter course, and as a consequence many departments of the Barrow Shipyard are very indifferently supplied with men. As a consequence of this, Messrs. Vickers, Sons & Maxim devised their scheme for building a thousand houses on Walney Island, within easy reach of their works, as previously chronicled in the MARINE ENGINEER, and until they can get these houses ready a floating home has been furnished for about 400 men on board the s.s. *Alaska*. As this is a very novel feature in shipbuilding experience, our correspondent has furnished us with the copy of a circular setting forth the way in which Messrs. Vickers's workmen will be treated on the *Alaska*:—

"In order to provide for the comfort and convenience of their workmen, who cannot get convenient houses or lodgings, Messrs. Vickers, Sons, & Maxim have acquired this vessel, which has been thoroughly overhauled and equipped as a temporary home, with good sleeping accommodation, dining, smoking, reading, and recreation rooms, promenade deck, baths and conveniences, the whole lighted throughout with electricity. The food will consist of:—Breakfast: Eggs, bacon, or fish. Dinner: Beef, mutton (boiled or roasted), with potatoes and bread, varied with steak pudding, hotch-potch, &c. Tea: Bread, butter, jam, cheese, cold meat, &c. Everything to be of the best quality, subject at any time to the committee's inspection. Washing of all underclothing and mending of clothes will be provided. For the above an inclusive charge of 14s., 15s., or 16s. per person per week will be made, according to the berth occupied, viz.:—If a cabin to hold two persons, 14s. per week each; if a single cabin, 15s. per week each; if a large single cabin, 16s. per week each. The internal management of the home will be under the direct control of the purveyor and his staff, and of a committee, Messrs. Vickers, Sons & Maxim retaining a general supervision over the management. It is also proposed that the men should form a club at a subscription of 1s. per annum. The relatives and friends of workmen will have permission to visit those lodging in the home. Workmen employed in the engineering side and shipyard department and men working at the dock may gain entrance to the ship through the works. Arrangements have been made for the accommodation of 100 workmen on 24th August, and additional accommodation will be speedily provided." It will be seen from this that the men living on the *Alaska* will lead a club life, and that their comfort and convenience will be considered in a way that would not be perhaps possible in ordinary lodgings. The movement has "caught on," and it is probable Messrs. Vickers will have no difficulty in getting all the accommodation on the ship taken up. When they are able to do this they will get an increased number of workmen in their employ, and this number will be still further increased when the new houses to be built on Walney Island are ready for occupancy. The new village which these houses will bring into existence will be known as Vickersdale. It is to be built on modern and model lines with good, airy streets and back streets, well designed cottages, possessing good-sized rooms, with lofty ceilings, and fitted with bathrooms, hot and cold water, and all conveniences likely to make the houses very pleasant homes. There will be a public square, athletic grounds, children's playgrounds, and a public park, and the houses will be situated practically on the east side of Walney Channel, across which is the town of Barrow, and within easy distance of the works of Messrs. Vickers, Sons & Maxim. It is proposed to build a high-level bridge to span Walney Channel. When that is done, Walney Island will probably be opened out to industrial enterprise, as well as developed into a charming seaside resort.

The work of fitting the engines and boilers in the Pacific Liner *Ortona*, is proceeding apace, and she is expected to be ready for sea in the early part of November. When she leaves the docks at Barrow, the Ramsden Dock entrance lock will be closed pending the work of lowering the sill at this place 6ft. The entrance here is 100 ft. wide, and when the sill is lowered, a vessel drawing 30 ft. of water can get in and out of the docks. This is a very desirable improvement seeing the larger class of war and other ships now building at Barrow, and seeing also the bigger class of steamers which are coming to the port nowadays. When the sill has been lowered, it is probable the Furness Railway Co. will commence the construction of a new graving dock and lock alongside the Ramsden Dock entrance for deep draught ships. This dock, which will be about 1,000 ft. long and 100 ft. wide, will have 30 ft. depth of water, and will be capable of accommodating the largest ship afloat, or any ship likely ever to be built. The dock will have an entrance from Walney Channel, and from Ramsden Dock. When completed it will enable local shipbuilders to do a big trade in the repairing of ships.

Considerable progress is being made with the three first-class cruisers building at Barrow, and with the Japanese warship, but it is probable before these can be launched the sill of the Ramsden Dock lock will have been lowered.

The adoption of electricity for driving purposes in the Barrow Yard is gradually being proceeded with, and it is found to be of very great advantage, and undoubted economy. The installation is working very satisfactorily, and every day almost gives the dynamos new loads.

In connection with the serious accident to H.M.S. *Bullfinch* it is interesting to note that the Barrow Yard was very unsuccessful with the torpedo-boat-destroyers built here until the shafts and other parts connected with the engines built of steel were made of Vickers's special steel. Other makes of steel proved failures, but when Vickers's material was substituted no difficulty occurred, and the engines showed great reliability when exerting full power and under the greatest strain.

Some discussion has been going on in the papers lately about the desirability of establishing another Bank Holiday, to be fixed between the August Bank Holiday and Christmas, and to be designated the Victoria holiday As far as this district is concerned, Bank Holidays, although very good and very necessary in themselves, constitute a great nuisance to the shipbuilder and the engineer, because the men take, four times a year, a longer spell of leisure than is desirable, and they do not, in a large percentage of cases, return to work for some days after the time at which notices are posted that work will be resumed. The men who are anxious to take a reasonable holiday and to return to work when it is over, are prevented from doing so because others have not got to the end of their surplus money or of the holiday spirit with which they are actuated. The proposal to add another Bank Holiday to the present list would certainly meet with disfavour amongst shipbuilders and others engaged in trade in this neighbourhood.

The new gun-mounting department added to the Naval Construction Works of Vickers, Sons & Maxim has now been completed, and is replete with the very best machinery modern engineering science can furnish. This department is crowded with work, and is likely to remain so for a long time to come, as orders are so very fully held. Indeed, it has already become necessary to increase the area covered by these works, and orders have accordingly been given out for the erection of additional sheds and for the purchase of the necessary machinery and other plant A new steel foundry is being built in the yard, and there are indications of other enlargements in various directions so as to make the works more and more complete and more self-resourceful.

West Cumberland.—There is no new feature to note in the shipbuilding trade of West Cumberland. Orders are plentifully maintained, and the yards at Maryport are very busy and likely to remain so.

Shipbuilding Material.—There is a very full and steady demand for all classes of shipbuilding material, and makers are still very fully employed. This is especially the case as regards ship plates and sections, boiler plates, &c., whilst steel forgings are in very full demand. Orders for all classes of material are being offered freely as well for Admiralty as for ordinary mercantile tonnage. Prices are very steady at £7 12s. 6d. for ship plates, £8 15s. for boiler plates, and £7 2s. 6d. for angles. Steel-makers have enjoyed a long run of prosperity, and from present appearances it is not probable it will be interfered with for a very long time to come.

The Hematite Trade.—The hematite pig-iron trade has been somewhat erratic during the month. Makers at one time lifted their prices to 80s. for mixed Bessemer numbers net f.o.b. They are still very firm at 75s to 77s., whilst warrant iron has varied in price very much, and is now quoted at 72s. 6d. net cash sellers, 72s. 5½d. buyers. Stocks have been increased during the month by about 5,000 tons.

Correspondence.

[*We do not in any way pledge ourselves to the opinions proffered under this heading.*]—Ed. M.E

A NEW METHOD OF FORCED DRAUGHT.

To the Editor of The Marine Engineer.

Sir,—I see in your issue of August 1st a short article on a communication I made to the Institution of Naval Architects, on some experiments carried out with forced combustion by means of hollow fire-bars. I now ask you to correct an error which may lead to a misunderstanding and give a false value to the experiment with natural draught.

The 10 days' work at natural draught was not 10 days' continual steaming at sea, as seems to have been supposed; but 10 days' work in a small supplementary boiler in a factory, from 6.30 a.m. to 5 p.m., which is obviously a different matter.

The system is still in the infant stage, and whether it will live to grow to maturity remains to be seen. "It promises well," as you remark, but we must not shut our eyes to the fact that the crucial test will be that of sudden stoppages at sea with heavy fires. Whilst the current is passing through the bars they keep too cool for the clinker to burn them, but it is possible that by stopping the fan with heavy fires and bad coal, the slaggy matter which forms the clinker may run over the bars and burn them. With the coal used during the experiments on shore such has not been the case; in other words, as far as can be judged, the cold bars seem to cool the under surface of the clinker sufficiently to prevent the union of the metal and the slaggy matter of the said clinker even when the current of air is stopped.

Naples. Nelson Foley.
August 7th, 1899.

THE "KAISER FRIEDRICH DER GROSSE."

To the Editor of The Marine Engineer.

Dear Sir,—In your esteemed journal of August 1st, page 207, you write that the *Kaiser Friedrich* has been withdrawn by the Norddeutscher Lloyd from the service and returned to her builders.

This not being the fact, I request you kindly to rectify it, in the next issue of your esteemed journal, according to the following data:—

The *Kaiser Friedrich* was the property of the firm of F. Schichau, and in spite of her being built as a high-speed passenger steamer, requiring a good quality of coal, the Norddeutscher Lloyd mostly gave her a very inferior coal—besides, many of the stokers had no previous experience.

Under these circumstances it could not give surprise that the *Kaiser Friedrich* was not able to develop her full speed, and there was no other way for the firm of F. Schichau but to withdraw its steamer and give her into other hands.

The *Kaiser Friedrich* will make her next voyages under the flag of the Hamburg-American Line.

Reiterating to you in advance my best thanks for this rectification, I remain, dear sir,

Elbing Yours very respectfully,
August 7th, 1899. F. Schichau.

THE WILSON LINE AND WATER-TUBE BOILERS.

To the Editor of The Marine Engineer.

Sir,—In your Thames Notes—current issue—you mention the *Hero* as having had her Scotch boilers taken out. Our s.s. *Hero* has never had other than water-tube boilers. The comparison you quote refers to our s.s. *Sasso*.

Yours truly,
For Thos. Wilson, Sons & Co, Limited
Hull, A. F. White.
August 8th, 1899.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Bernicia.—On July 8th there was launched at Middlesbrough, for Messrs. J. Browser & Sons, Newcastle, a steel schooner-rigged steamer of about 430 tons gross, named the *Bernicia*.

Khartoum.—On July 11th there was launched at Hull, for the Hull Steam Fishing & Ice Co., Limited, Hull, an iron and steel steam ketch of about 300 tons gross, named the *Khartoum*.

Maristow.—On July 13th there was launched at Sunderland, for Messrs. Bellamy & Co., Plymouth, a steel schooner-rigged steamer of about 3,600 tons gross, named the *Maristow*.

Pearl.—On July 15th there was launched at Whitby, for Mr. J. Constant, of London, a steel schooner-barge of about 240 tons gross, named the *Pearl*.

Achecolanda.—On July 22nd Messrs. Pickersgill & Sons launched at Sunderland a steel crew cargo steamer, of the single deck type. The dimensions of the vessel are as follows:—Length, 295 ft.; breadth, 43 ft.; and depth moulded, 21 ft. She had been built to Lloyd's highest class under special survey. The engines and boilers are supplied by Messrs. Geo. Clark, Limited, of Southwick, the former being of the triple-expansion type, with cylinders 21 in., 35 in., and 57½ in., with a 39 in. stroke. The vessel was named *Achecolanda*.

Commander Cawley.—On July 24th there was launched at South Shields, by Messrs. Eltringham & Co., the steam pilot cutter *Commander Cawley*, of the following dimensions:—128 ft. over all, and 23 ft. by 11 ft. 4 in., and is built to Lloyd's 100 A1 class. The engines are to be direct acting, inverted cylinder, triple compound, three-crank engines, fitted with surface condenser; and the ship is to have a guaranteed speed of not less than 10 knots.

Ethel.—On July 24th a trawler was launched from the Selby Shipbuilding Co.'s yard. She is a sister ship to the *Kathleen and Elsie*, built by the same firm for the Central Steam Fishing Co., Grimsby, was christened *Ethel* by Miss Leetham, of York.

Nuttallia.—On July 24th there was launched at Grimsby, for the North-Eastern Steam Fishing Co., Grimsby, an iron steam yawl of about 189 tons gross, named the *Nuttallia*.

Steel Screw Steamer.—On July 24th there was launched at Middlesbrough, by Messrs. Harkess & Son, a steel screw steamer, which they have built to the order of Messrs. Furness, Withy, & Co., Limited, of West Hartlepool. Her engines, designed to give the vessel a speed of about nine knots loaded at sea, are by Messrs. Sir Christopher Furness, Westgarth & Co., Limited.

Seaton.—On July 25th there was launched at South Shields for the North-Eastern Railway Co., a steel steam tug, of about 160 tons gross, named the *Seaton*.

Elfleda.—On July 25th Sir Raylton Dixon & Co, Limited, launched from their Cleveland Dockyards, Middlesbrough, a handsome modelled twin-screw mail and passenger steamer, built for Messrs. Elder, Dempster & Co., of Liverpool. Her principal dimensions are 382 ft. by 46 ft. by 25 ft. moulded. Accommodation will be provided for 108 first-class, and 50 second-class passengers in most spacious and handsomely fitted cabins, with large dining room, panelled in marble and inlaid wood in house on deck. The first class smoking room, second-class smoking room and cabin entrances will be elaborately fitted and decorated, and the vessel will be lighted throughout with electric light. A powerful refrigerating machine with large cooling chambers will also be provided for the conveyance of fresh meat, provisions, &c. Twin-screw triple-expansion engines will be fitted by the Wallsend Slipway and Engineering Co., Limited, Newcastle-on-Tyne, having cylinders 21½ in., 34 in., 59 in., by 42 in. stroke, supplied with steam by four large single-ended boilers working at 130 lbs. pressure, and fitted with Howden's system of forced draught. The ship and engines have been built under the supervision of Mr. G. H. Butterworth, resident inspector. On leaving the ways she was christened *Elfleda* by Mrs. Waynman Dixon.

Suffolk.—On July 25th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, at Wallsend, a handsome screw-steamer, built to the order of Messrs. Birt, Potter & Hughes, Limited, for their well-known line of steamers. The register length of the vessel is 420 ft.; breadth register, 54 ft.; and depth, moulded, 32 ft.; having complete shelter deck for the use of cattle or light cargo. The sailors and firemen are berthed under the shelter deck aft. Provision for the accommodation for captain, engineers, officers, and a few passengers is made on the top of the shelter-deck in large deck-houses. The handsome saloon is tastefully fitted in polished oak, and complete with every comfort. The vessel is constructed on the deep frame principle, thus dispensing with hold beams, and has cellular water ballast all fore and aft, and both peaks fitted as tanks. The shelter, upper, and main decks are of steel, and her class will be 100 A1 Lloyd's, three deck grade, with shelter deck, special survey, also Board of Trade passenger certificate; her deadweight carrying capacity is 8,750 tons. The deck machinery consists of 10 large steam winches, by Mr. R. Welford, of Pallion, and direct steam windlass by Messrs. Emerson, Walker, & Thompson. Alley, McLellan's steam-steering gear, which is placed in the engine room, and worked from flying bridge, together with all the usual appliances for handling cargo and working the ship with the greatest possible despatch. The main engines are upon the tri-compound principle by the North Eastern Marine Engineering Co., Limited, Sunderland, and have cylinders 30 in., 48 in., and 78 in. by 54 in. stroke, steam being supplied by three large steel boilers, working at a pressure of 160 lbs. per square inch. During construction the steamer and her machinery has been inspected on behalf of the owners by their superintendent, Mr. Morrison, and also by Captain Cuthbert (who will take command of the vessel), and by Mr. Justice, and upon leaving the ways was gracefully named *Suffolk* by Mrs. Morrison, after which she was towed into the South Dock for the purpose of masting, &c. This vessel is being insulated all fore and aft by the builders with silicate cotton for the carriage of frozen meat, and she will be fitted with refrigerating machinery by Messrs. J. & E. Hall, of Dartford, Kent.

Jerid.—On July 26th there was launched at Hull, for the Great Grimsby and East Coast Steam Fishing Co., Limited, Grimsby, an iron steam ketch, named the *Jerid*.

Robert Irvine.—On July 26th, Messrs. Irvine's Shipbuilding & Dry Docks Co., Limited, launched from their shipyard a finely modelled steel screw steamer built to the order of Messrs. Robert Irvine & Co., Tower Chambers, West Hartlepool. She is of the following dimensions:—Length, 352 ft.; breadth, 48 ft.; depth, 27 ft. 9 in., and is of the single-deck type, with poop, bridge, and forecastle, is built to Lloyd's highest class under special survey, and capable of carrying 6,000 tons deadweight on a light draught with Lloyd's summer freeboard. A double bottom is fitted throughout on the cellular principle for water ballast. and the after peak is arranged as a trimming tank. She is constructed with deep frames, web frames and longitudinal stringers, thus dispensing with hold beams which gives clear holds for the storing of bulky cargoes. Six water-tight bulkheads divide the holds into seven watertight compartments, and each hold is fitted with iron grain divisions. She is fitted with extra large cargo hatches, and is equipped with double derricks at each hatch, seven steam winches and is replete with all the latest improvements for rapid loading and discharging. A powerful direct steam windlass is fitted forward for the working of the cables, and a steam-steering gear is fitted amidships. The saloon, and captain and officers' accommodation is provided in a house at the fore end of bridge, and the engineers are berthed on the bridge at the side of casings. The seamen and firemen are housed under the forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Engines of the triple-expansion type are being supplied by Messrs. Thomas Richardson & Sons, Limited, Hartlepool, with cylinders 24 in., 39 in., 66 in., and 45 in. stroke, and two single-ended boilers constructed to work at a pressure of 180 lbs. As the vessel left the ways, the christening ceremony was performed by Miss Irvine. of Ragworth Hall, who named the vessel *Robert Irvine*, in compliment to the founder of the firm of Robert Irvine & Co., Tower Chambers.

Cito.—On July 27th, Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched at Hull a fine screw steamship, for Messrs. Thomas Wilson, Sons & Co., Limited, Hull. Her dimensions are 219 ft. by 30 ft. by 17 ft. 9 in., and she is fitted with water-ballast in a double bottom in the fore hold, in the fore peak, and in a deep tank in the after hold. She has a large bunker capacity, one complete deck with poop, bridge, and forecastle, and under the latter the crew is berthed. Accommodation is provided in a house on the fore end of the bridge for the captain and officers. Stalls for horses are provided under the bridge. She has three masts, is schooner-rigged, and has four steam winches; also a steam windlass and steam-steering gear. The vessel will be propelled by triple expansion engines, having cylinders 18 in., 30 in., and 50 in. diameter, by 33 in. stroke, steam for which will be supplied by two steel boilers, working at 200 lbs. steam pressure. The christening ceremony was performed by Miss Jessie Cole, daughter of Earle's shipyard manager, who named the vessel *Cito.*

Tresillian.—On July 27th there was launched at South Shields, from the Shipbuilding yard of Messrs. John Readhead & Sons, a screw steamer, built to the order of Messrs. Edward, Hain & Son, St. Ives, Cornwall. The vessel, which is 353 ft. long, 46 ft. 6 ins. broad, and 27 ft. 4 in. in depth, is of the improved single-deck type, and classed 100 A1 at Lloyd's under special survey. The steamer will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 24 in., 40 in., and 65 in., with 45-in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lb. per square inch. The steamer was named the *Tresillian*, and is the 34th vessel built for the above firm by Messrs. John Readhead & Sons.

Ledokol III.—On July 28th Messrs. Sir W. G. Armstrong, Whitworth & Co., launched from their Walker Shipyard on the Tyne an ice-breaking steamer, intended for work at the port of Odessa. The chief dimensions of the vessel are:—Length, 158 ft.; breadth, 42 ft.; depth, 25 ft. 5 in. She has been built to Lloyd's and Board of Trade requirements, and was named *Ledokol III.* Immediately after the launch the ice-breaker was taken to the works of the Wallsend Slipway & Engineering Co., where she will be fitted with triple-expansion screw machinery. Although a small vessel, she is to be fitted with very powerful machinery.

Champion.—On July 29th there was launched at Hull for the Anchor Steam Fishing Co., Limited, of Grimsby, a steel steam ketch, of about 198 tons gross, named the *Champion.*

Vampire.—On July 29th there was launched at Hull for the Atlas Steam Fishing Co., Limited, of Grimsby, a steel steam ketch, of about 198 tons gross, named the *Vampire.*

Glenroy.—On Saturday, August 5th, Messrs. William Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of Messrs. Livingston, Conner & Co., of West Hartlepool. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length, overall, 329 ft.; breadth, 46 ft.; and depth, 23 ft. 6 in.; and 4,650 tons deadweight capacity on a light draught. The deck erections consist of a poop, bridge over machinery space, and topgallant forecastle. A handsome saloon and cabins for officers, &c., will be fitted in a large house on the bridge. The engineers' rooms are also on the bridge, and the crew's accommodation forward. The hull is built on the deep bulb frame principle, with a cellular double-bottom large hatchways, extra powerful steam winches, steam-steering gear amidships, hand-screw gear aft, patent donkey boilers, patent direct steam windlass, boats on beams overhead, shifting boards throughout, stockless anchors, two masts with schooner rig, and all the most approved appliances for a first-class cargo vessel will be supplied. The Central Marine Engine Works of Messrs. William Gray & Co., Limited, supply triple-expansion engines, having cylinders 23 in., 36½ in., and 62 in. diameter, with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The ceremony of christening the steamer *Glenroy* was gracefully performed by Miss Conner, daughter of one of the managing owners.

Balakani.—On August 8th the s.s. *Balakani* was launched from the yard of Messrs. Sir James Laing & Son, Limited, Sunderland. She has been specially constructed for the carriage of petroleum in bulk for Messrs. Lane & Macandrew, of London, and is the second of three steamers building by Messrs. Laing for that firm. The principle dimensions are:—Length, 335 ft.; breadth, 45 ft.; moulded depth, 29¾ ft.; and her engines have cylinders 24½ in., 40 in., and 66 in., with a 40 in. stroke, and take steam at 180 lbs. pressure from two powerful single-ended boilers. All the latest improvements in auxiliary machinery are fitted, including powerful pumping installation, electric light fitted throughout the ship, steam-steering gear winches and steam windlass, and a donkey boiler of large size. The vessel and her machinery have been built to the highest class at Lloyd's and Bureau Veritas, and conforms to the Suez Canal regulations, and, like her sister ships, has been constructed under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool.

Protector.—On August 8th there was launched at Sunderland, by Messrs. Robert Thompson & Sons, a steamer named the *Protector*, for a Boston firm. The vessel was launched sideways into the river.

Baron Eldon.—On August 9th Messrs. Bartram and Sons launched at Sunderland, for Mr. Hugh Hogarth, Glasgow, a large steel steamer of the spar deck type. The principal dimensions are:—Length, 340 ft.; breadth, 48 ft.; depth, 28 ft. 6 in. She has been built to take the highest class in Lloyd's Registry, and under the personal supervision of Captain Murphy, of Glasgow, on behalf of the owners. The propelling machinery will be supplied by Messrs. John Dickinson & Sons, Limited. The cylinders are 24½ in., 40 in., and 66 in. by 45-in. stroke. The vessel was named the *Baron Eldon.*

Lynton.—On August 9th there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons a fine screw steamer, specially designed for cargo and cattle trade, and built to the order of the Liverpool Shipping Co., Limited, of Liverpool. Her dimensions are:—Length B.P., 340 ft.; breadth, extreme, 45 ft.; and depth moulded, 25 ft. 9 in., and will carry about 5,200 tons on 21 ft. draught. She is constructed with extra strength to obtain Lloyd's minimum freeboard for three-deck vessels. There is a cellular bottom and peaks for water ballast divided into transverse and longitudinal divisions for trimming purposes. The accommodation for captain, officers, and engineers being placed in large houses on the bridge deck leaves the bridge and poop spaces clear for cargo if required. The crew are provided for in the topgallant forecastle. The cabins and saloon are tastefully designed in different shades of oak. There are five large cargo hatches with powerful steam winches and double derricks for rapid loading and discharging of cargo. The steam-steering gear is fitted at after end of engine-room, with control shafting to wheelhouse on upper bridge. The vessel is fitted with all the most modern improvements for a first-class cargo and cattle steamer. The engines are by the North Eastern Marine Engineering Co., Limited, and have cylinders 23 in., 39 in., and 65 in., with 42 in. stroke, and extra large boilers of 180 lbs. pressure. During construction the ship and machinery have been personally superintended by Messrs. Maxton & Sinclair, of Liverpool and Belfast. As she left the ways she was gracefully christened *Lynton* by Mrs. Sproule, wife of the managing owner.

Lucifer.—On August 10th there was launched from the West Yard of Messrs. C. S. Swan & Hunter, Limited, Wallsend, a steel screw steamer of the following dimensions:—Length overall 354 ft., beam extreme 47 ft., and depth moulded 29 ft. She has been built to the order of the Bear Creek Oil and Shipping Co., Limited, of which company Messrs. C. T. Bowring & Co., of Liverpool, are the managers, and is designed to carry 5,000 tons of petroleum in bulk as well as 500 tons of bunker coal. The propelling machinery has been built by T. Richardson & Sons, Limited, of Hartlepool, and consists of a set of triple-expansion engines having cylinders, 24 in., 40 in., and 66 in. diameter, with a stroke of 45 in., steam being supplied by two large single ended boilers, each 15 ft. 9 in. diameter, and 10 ft. 6 in. long, working at a pressure of 180 lbs. per square in. During construction the vessel and her machinery have been under the supervision of Mr. Bradney, representing Messrs. Jacobs & Barringer, of London. On leaving the ways the vessel was gracefully named *Lucifer* by Miss M. C. Bowring, of Liverpool.

Steam Trawlers.—On August 10th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, two new steam trawlers, Nos. 260-1, built to the order of the Great Central Co-operative Engineering and Ship Repairing Co., Limited, Grimsby. Dimensions 110 ft. by 21 ft. by 11 ft. 3 in. depth of hold. Triple-expansion engines will be supplied by the owners. The vessel will be completed ready for sea with all the most modern appliances for trawling. The launching ceremonies were performed by Mrs. Watson and Mrs. Cooper, of Beverley, respectively. Mr. Dunlin, of Grimsby, represented the owners.

Avondale.—On Saturday, August 19th, Messrs. Short Brothers launched from their shipbuilding yard at Pallion, a handsomely modelled steel screw steamer, built to the order of Messrs. G. H. Elder & Co., of Newcastle-on-Tyne. The vessel has been built under special survey to the highest class in Lloyd's register, and is of the following dimensions, viz.:—Length

285 ft., breadth 43 ft., depth moulded 21 ft., and is of the single decked type. The vessel is fitted with a full poop, long bridge amidships on which houses are fitted up for the accommodation of captain and officers, and topgallant forecastle for crew. There are four large hatchways with a powerful steam winch at each, steam being supplied to the latter by a large multitublar donkey boiler placed in the stokehold. The double bottom, which is on the cellular principle is subdivided into trimming tanks for water ballast. On leaving the ways the vessel was named *Avondale*, the ceremony being gracefully performed by Mrs. Elder, of Newcastle-on-Tyne. The vessel is to be fitted with triple-expansion engines by Messrs. George Clark, Limited, of Sunderland, having cylinders 21 in., 35 in., 57½ in. by 39 in. with two boilers 13 ft. by 10 ft. 6 in., 160 lbs. pressure. The construction of the vessel has been under the supervision of Captain Fothergill, who will take command of the vessel on completion.

Hero.—On August 19th there was launched at Hylton, from the yard of Messrs. Osbourne, Graham & Co., a finely-modelled steamer, especially designed for general cargo purposes, and built to the order of Messrs. Brunsgaard, Kiosterud & Co., of Dram, Norway. Her dimensions are :—Length over all, 351 ft.; beam, extreme, 48 ft. ; and depth, moulded, 29 ft. She will carry about 6,100 tons on 23 ft. draught. She is constructed with extra strength to obtain Lloyd's minimum freeboard for this class of vessel. There is a cellular bottom for water ballast, and both fore and-aft peaks are fitted as tanks, giving the vessel over 1,000 tons of ballast capacity, which will enable the vessel to make passages in ballast with comfort and safety. The deck machinery consists of six powerful steam winches, quick warping steam windlass, all worked from a large multitubular donkey boiler. There is also a powerful hand and steam combined steering gear, fitted on the bridge, and a screw gear aft. The vessel will be propelled by triple-compound engines, built by the North-Eastern Marine Engineering Co., and will have cylinders 25 in., 41 in., and 67 in. in diameter by 45-in. stroke, steam being supplied by two single-ended boilers 16 ft. by 10½ ft., working at a pressure of 160 lb. As the vessel left the ways she was named *Hero* by Miss Syversten, after which she proceeded to Wallsend, where she will have her machinery fitted.

Steel Barge.—On August 19th there was launched from the yard of Mr. Joseph Scarr, Grovehill, Beverley, a steel barge of the following dimensions:—Length overall, 90 ft.; beam, moulded, 24 ft. 6 in.; depth moulded, 8 ft. 6 in. She was built to the order of the London Grain Elevator Co., of London, and is the second built for that firm.

Darleydale.—On Monday, Aug. 21st, Messrs. W. Gray & Co., Limited, launched a fine large steel screw steamer for the Dale Steamship Co., Limited, Messrs. Lucas & Co., of Bristol, managers. She will take Lloyd's highest class and is of the following dimensions, viz.: Length overall, 336 ft.: breadth, 48 ft. 6 in.; and depth, 24 ft. The deck erections consist of poop, long bridge, and forecastle; the saloon, and captain's and officers' rooms will be fitted in the poop. The hull is built with deep frames and cellular double bottom, and aft peak tank for water ballast, five steam winches, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, patent donkey boiler, grain divisions, stockless anchors, and a complete outfit will be fitted for a first-class cargo boat. Three cylinder triple expansion engines of first-class make are being supplied by the Central Marine Engine Works, of Messrs. W. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and large steel boilers, to work at a pressure of 160 lbs. per square inch. The ceremony of christening the steamer *Darleydale* was gracefully performed by Mrs. Davis, wife of Captain Davis, who will command the *Darleydale*.

Manchester Commerce.—On Monday, August 21st, Messrs. Furness, Withy & Co., Limited, launched from their Middleton Shipyard, West Hartlepool, the finely-modelled steel screw cattle and cargo steamer *Manchester Commerce*, built to the order of the Manchester Liners, Limited, of which firm Sir Christopher Furness is chairman. The vessel is built expressly for the Manchester Liners' service from the Manchester Canal to Canada. The vessel has four masts and is rigged fore and aft with telescopic topmasts and funnel to suit the Manchester Canal bridges, and the scantlings of the vessel are considerably in excess of Lloyd's highest class. The *Manchester Commerce* is 445 ft. long, of the three-decked type with two steel decks laid all fore and aft, and has poop, bridge, and forecastle, and strengthened wood shelter deck between erections, and the vessel is strengthened considerably above Lloyd's requirements to suit the Atlantic trade. All the available space under the shelter deck, upper deck, and bridge is fitted throughout to pass American and Canadian regulations, with the most improved and modern arrangements for carrying 756 head of cattle. A large insulated hold of 10,000 cubic feet is fitted with refrigerating gear for the storage of frozen meat, fruit, &c. The accommodation for the captain is in the saloon, and spare state-room, &c., is arranged on the bridge deck in a large steel deckhouse, with separate house for officers. The engineers are housed at the fore end of the bridge, the seamen and firemen under the forecastle, and the cattlemen in the poop. A cellular double bottom is fitted all fore and aft for water ballast, and there are also four separate tanks under engines and boiler space for fresh water for cattle supply. A specially strengthened deep tank is fitted just aft of the engine-room and both fore and after peaks are fitted for water ballast, giving a total ballast capacity of 1,700 tons. The vessel is divided into nine watertight compartments by means of eight steel bulkheads. Each compartment is fitted with complete grain divisions. A most complete system of ventilation has been arranged to ensure the safe carriage of cattle, grain, or other cargoes. The vessel has eight hatches, eight powerful steam winches, and sixteen derricks provided for the rapid loading and discharging of cargo. Special attention has been devoted to the bunkering arrangements of this vessel so that the bunkering can be carried out in an efficient manner. A powerful steam windlass is fitted forward for working the cables, and combined hand and steam-steering gear is fitted in the after end of the poop. The vessel is lighted throughout by electricity, and will be fitted up as a first-class cattle and cargo steamer, including all the most modern improvements for the Atlantic trade. The engines will be supplied by Messrs. Sir C. Furness, Westgarth & Co., Limited, Middlesbrough, and are of the inverted triple-expansion type, having cylinders, 28 in., 46 in., and 78 in., by 54 in. stroke, steam being supplied by three single-ended boilers 14 ft. 9 in. by 12 ft. and 190 lbs. working pressure; Howden's forced draught being also fitted in connection with the boilers. The *Manchester Commerce* is a sister ship to the *Manchester Corporation*, launched by Messrs. Furness, Withy & Co. for the same owners and now being completed at their yard. On leaving the ways the ceremony of christening the vessel *Manchester Commerce* was gracefully performed by Miss Ethel Withy, daughter of Mr. Henry Withy, J.P., Brantford House, West Hartlepool.

Clan Urquhart.—On August 22nd Messrs. William Doxford & Sons launched from their yard at Pallion the *Clan Urquhart*, the tenth vessel of the turret type built for the Clan Line of steamers, Limited, Glasgow (Messrs. Cayzer, Irvine & Co.), and the 52nd turret afloat. Her dimensions are:—Length. 440 ft.; breadth, 51 ft. 6 in.; depth 32 ft., moulded; deadweight, 8,400 tons. Her engines, 27½ in., 45½ in., 75 in. by 60-in. stroke, are also built by the firm. The vessel is classed with the British Corporation, and on leaving the ways was christened by Miss Constance Cayzer.

Karamea.—On August 22nd the *Karamea*, a large four-masted steel screw steamer, constructed by Messrs. R. and W. Hawthorn, Leslie & Co., Limited, for Messrs. Shaw, Savill & Albion Co., Limited, London, was launched from their shipyard at Hebburn-on-Tyne. Her principal dimensions are: —Length, over all, 435 ft.; breadth, 54 ft.; depth, 40 ft. to shelter deck. The *Karamea* is the sixteenth of a series of 18 vessels built and building by them for the Australian and New Zealand frozen meat trade. The cargo hatches are specially adapted to afford the greatest possible facilities for loading and discharging the holds and 'tween decks. The vessel carries a number of passengers. She is intended for carrying frozen meat from the Colonies, and has the whole of her forward end, including three holds and 'tween decks, insulated with refrigerating apparatus on the Haslam dry air system. The engines of the vessel have been built by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, at their St. Peter's works, and are of the triple-expansion surface condensing type, with cylinders of 30 in., 48 in., and 78 in. diameter and 54-in. stroke, with four large single-ended boilers working at 160 lb. pressure. On leaving the ways the vessel was named the *Karamea*, by Mrs. Burton, wife of Captain Burton, R.N.R., commander of the vessel.

Hannover.—On August 22nd the s.s. *Hannover*, which is being constructed by Messrs. Wigham, Richardson & Co., Limited, for the Norddeutscher Lloyd, of Bremen, was launched from the Neptune Shipyard, Newcastle-on-Tyne. The *Hannover* is a fine steel twin-screw steamer, 445 ft. in length by 54 ft. beam. She is being fitted with twin-screw quadruple-expansion engines, balanced on the Yarrow, Schlick and Tweedy system, which are estimated to drive her at a good speed. The steamer will be suitably fitted up with comfortable accommodation for 24 first-class passengers and for about 750 emigrants. Special care has been taken for their safety, the vessel being subdivided by a most efficient arrangement of watertight bulkheads so as to be practically unsinkable. Besides, she will have no less than 14 lifeboats. In addition to the passengers the steamer will carry a large cargo. She will be completely lighted by electricity and heated by steam. There will be also steam bakeries, galleys, coffee mills, &c., as well as the most improved appliances for working the ship herself and her cargo. The owners were represented by Captain Dahl and Mr. Kruse, under whose inspection the work is proceeding, and the christening ceremony was gracefully performed by Mrs. Dahl, wife of Captain Dahl.

Caisson.—On Wednesday, August 23rd, Messrs. Edward Finch & Co., Limited, launched from their shipbuilding yard at Chepstow, a large caisson, which they have constructed for the Bristol Docks Committee, for use in the inner end of their Avonmouth Entrance Lock. Her principal dimensions and particulars are as follow:—Length, 71 ft.; breadth, 10 ft. 2 in.; depth, 34 ft. 9 in.; launching weight, 200 tons; hull, 110 tons; permanent ballast, 90 tons. She is built entirely of mild steel of Lloyd's quality, having four tiers of beams, two watertight decks, one stringer and an upper wood deck, and three transverse watertight bulkheads. The caisson is divided into eight watertight compartments. Six of these will be used as water ballast tanks for sinking the caisson into its position, having a total capacity of 325 tons. The water is admitted through the dock side of the caisson by 6 in. diameter pipes, each compartment having special valves, which are all worked from the upper deck. Greenheart facing timber is fitted on stems and keel, and an elm belting around both sides. The peculiar shape of this caisson, which in section is very much like a cigar, rendered the launching a very difficult operation. Three launchways were used, the main one being placed under the centre of the caisson, and an outer one about 8 ft. from this on either side, to which the caisson was shored from underneath her belting, thus giving a launching base of about 16 ft. Great care was necessary to ensure the ways travelling simultaneously, and Messrs. Finch & Co. are to be congratulated upon their clever arrangement of the many details, and the success which attended it.

Olanda.—On Wednesday, August 23rd, Messrs. William Gray & Co., Limited, launched the handsome steel screw steamer *Olanda*, for the Scheepvaart en Steenkolen Maatschappy, of Rotterdam. The vessel will take Lloyd's highest class, and her dimensions are:—Length, overall, 300 ft.; breadth, 42 ft.; and depth, 21 ft. 9 in. The deck erections consist of a poop, bridge, and forecastle, with tasteful saloon and cabins for captain, &c., in the poop. The officers' and engineers' rooms are in the bridge, and the crew's accommodation is forward. The hull is built with deep bulb-angle frames, and a cellular double-bottom and aft peak tank, four steam winches, steam-steering gear amidships, hand-screw gear aft, patent donkey boiler, steam windlass, boats on beams overhead, stockless anchors, two telescoping masts; and a complete outfit will be provided for loading and discharging quickly cargoes of coal, ore, &c., for carrying which the *Olanda* is specially adapted. The Central Marine Engine Works of Messrs. William Gray & Co., Limited, supply the triple-expansion engines, with cylinders 21½ in., 35 in., and 58 in. diameter, and a 39-in. piston stroke; also two large steel boilers to work at 160 lbs. pressure per square inch. The ceremony of naming the steamer *Olanda* was gracefully performed by Miss Nora Gray, daughter of Mr Tom Gray, late of Sunderland, and cousin of the managing owner, Mr. Victor R. Los, of Rotterdam, who was also present at the launch, along with Mr. Baggallay (of Messrs. Flannery, Baggallay & Johnson), Mr. Bullen, representing Messrs. H. E. Moss & Co., and Mr. Bonke, of Rotterdam.

Rokeby.—On August 23rd Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length, between perpendiculars, 340 ft.; breadth, extreme, 49 ft. 6 in; depth, moulded, 28 ft. 3 in. The vessel will take the highest class at Lloyd's, and is built off the three-deck rule to the order of Messrs. George Pyman, of West Hartlepool, having poop, bridge, and topgallant forecastle. The saloon and cabins for captain and officers will be fitted up in the poop, and the accommodation for engineers in iron houses on bridge deck, the crew being berthed in the forecastle as usual. She has double bottom on the cellular principle for water ballast, and has been designed to carry a deadweight cargo of about 6,300 tons, is fitted with all the most recent appliances for expeditious loading and unloading of cargoes, has direct steam windlass, steam-steering gear amidships, with powerful screw gear aft, six large steam winches supplied with steam from two donkey boilers. The vessel will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of 1,500 I.H.P. The christening ceremony was gracefully performed by Mrs. Fry, of Cardiff, who gave the vessel the name of *Rokeby*.

LAUNCHES.—SCOTCH.

Cruden Bay.—On July 24th there was launched at Anstruther a wooden steam ketch, of about 117 tons gross, named the *Cruden Bay*.

Blanche.—On July 25th there was launched from the yard of Messrs. S. McKnight & Co, Limited, Ayr, a fine steel screw steamer of the following dimensions:—145 ft. by 24 ft. by 11 ft. 3 in., constructed for Liverpool owners. The vessel on leaving the ways was gracefully christened *Blanche* by the daughter of the owner.

Atbara.—On August 4th Messrs. A. Rodger & Co. launched at Port-Glasgow a steamer of 4,650 tons deadweight carrying capacity, and of the following dimensions:—Length, 320 ft.; breadth, 46 ft.; depth, 23 ft. 9 in. The steamer, which has been built for Maclay & Macintyre, Glasgow, was named *Atbara* by Mrs. Fyfe, wife of Sheriff Fyfe, Glasgow. The machinery will be fitted on board by Hall, Brown, Buttery & Co.

Hillbrook.—On August 4th Messrs. Russell & Co., launched at Port-Glasgow, a steel spar-decked screw steamer, named *Hillbrook*, of the following dimensions:—Length, 340 ft.; breadth, 46 ft.; depth, 28 ft. 6 in; to carry 5,800 tons deadweight. The owners are Messrs. Hugh Evans & Co., Liverpool. The vessel will be engined at Greenock by Messrs. Rankin & Blackmore, the cylinders being 24 in., 39 in., 65 in. by 35 in. stroke.

Seabreeze.—On August 8th the launch took place at Paisley of a fine new steam yacht for Mr. Andrew Carnegie, of Skibo Castle. The yacht has been built to the highest classification in Lloyd's Registry, and is a fine, well-modelled, well-equipped yacht, being fitted out in a very complete and tasteful manner. Immediately after the launch the *Seabreeze* proceeded down the river for trials, which were highly satisfactory, and thereafter the yacht left for Skibo. The *Seabreeze* was engined by Messrs. Bow, M'Lachlan & Co, and built by Messrs. J. M'Arthur & Co., Paisley. As the yacht left the ways she was named *Seabreeze* by Mrs. M'Lachlan, of Paisley.

Clan Macfadyen.—On August 9th Messrs. Blackwood & Gordon launched at Port-Glasgow a steel screw steamer for Messrs. Cayzer, Irvine & Co., of Glasgow, for their Clan Line of steamers. The dimensions of the vessel are as follows:—Length, 326 ft.; breadth, 40 ft.; depth moulded, 26 ft. 2 in.; gross tonnage, 2,830 tons, with a deadweight carrying capacity of 4,000 tons. The vessel has been built to the three-deck rule, 100 A1 Lloyd's class, and has large poop, bridge, and forecastle. The saloon, captain's house, and chart-room are fitted up on bridge deck, the engineers' and officers' accommodation being fitted up under after end of bridge, the firemen and sailors being accommodated in poop. The steamer on leaving the ways was named *Clan Macfadyen* by Miss Constance Cayzer, daughter of Sir Charles Cayzer, principal director of the company. The steamer, after being launched, was placed in the builders' wet dock to receive her machinery and boilers, which have also been constructed by the builders.

Lutra.—On August 10th Messrs. Scott & Co. launched at Greenock the fine steam yacht *Lutra* for Lord Malcolm, of Poltalloch. The vessel, which is 150 ft. in length, 21 ft. in breadth, and 13 ft. deep, will be supplied by the builders with engines of 350 I.H.P., with cylinders 12 in., 10½ in. and 31 in., with a stroke of 26 in. The *Lutra*, which is of 300 tons yacht measurement, will be handsomely fitted up.

Tanagra.—On August 10th Messrs. Russell & Co. launched at Port-Glasgow a steel spar-decked screw steamer of 5,450 tons deadweight carrying capacity, to the order of Messrs. William

Thomson & Co., St. John, N.B. Dimensions:—Length, 330 ft.; breadth, 48 ft.; depth, 26 ft. The steamer is built to Lloyd's highest class. She will be supplied by Messrs. Kincaid & Co., Greenock, with triple-expansion engines of 24 in., 40 in., and 65 in. by 42½ in. stroke. The steamer was named *Tanagra* by Miss Philips, daughter of Lloyd's chief surveyor, Greenock.

Jed and Kennet.—On August 11th there were launched by the Irvine Shipbuilding and Engineering Co., Limited, at Irvine, two steel screw steam trawlers for Hull owners. The vessels were built to Lloyd's highest class under special survey, and are fitted with all the latest appliances for the North Sea fishing Dimensions: 105 ft. between perpendiculars, by 21 ft. by 11 ft. 6 in. moulded. Messrs. Muir & Houston, Limited, Glasgow, are supplying the vessels with triple-expansion engines of about 250 I.H.P., and having cylinders 10 in., 16 in., and 27 in. by 20 in. stroke, steam being supplied by a steel boiler working at 180 lbs. pressure. As the vessels left the ways they were respectively named *Jed* and *Kennet* by Miss Mary Gilmour, of Irvine, and Miss Nellie Ferguson, of Irvine.

Pera.—On August 14th Messrs. Mackie & Thomson launched at Govan the steel screw steamer *Pera*, which they have built for Messrs. Bailey & Leetham, Hull, for general trading purposes. The dimensions of the vessel are:—Length, 225 ft. between perpendiculars: breadth, 34 ft. extreme; moulded depth, 16 ft. 7 in.; and carrying capacity, 1,700 tons on a mean draught of 15 ft. Triple-expansion engines will be supplied by Messrs. Muir & Houston, Limited, Kinning Park. The vessel, which is built to Lloyd's 100 A1 class, and will be rigged as a fore-and-aft schooner, with two pole masts, was named by Mrs. Mackie, Falkland Bank, Partick.

Finanzminister Witte.—On August 15th Messrs. Robert Duncan & Co., Limited, launched at Port-Glasgow a steel screw steamer of 2,000 tons deadweight for "Rossija" Steamship Co., of Libau, Russia. The dimensions are 235 ft. by 34 ft. 6 in. by 18 ft. 9 in. moulded. Messrs. Hall Brown, Buttery & Co., Govan, are supplying triple-expansion engines 18½ in., 30 in., 49 in., by 33 in stroke; two boilers 12 ft. by 9 ft. 6 in., 160 lb. water pressure. There are three large hatches 27 ft. long, and one smaller one aft; steam winch to each hatch, steam windlass and steam-steering gear, and all modern equipments, for the Baltic trades. The capacities for cargo measure about 100,000 cubic feet. Captain, officers, and engineers have their accommodation on the top of the bridge amidships; while the crew are housed forward. As she left the ways she was named *Finanzminister Witte* by Mrs. Mees, wife of the Russian Consul, Glasgow, and was afterwards towed to Glasgow to receive her machinery. The vessel has been built to Lloyd's 100 A1 class.

Kildonan Castle.—On August 22nd there was launched from the Fairfield Shipbuilding and Engineering Co., Limited, Govan, Glasgow, the *Kildonan Castle*, the second of the two magnificent twin-screw steamers of 10,000 tons which the Castle Mail Packets Co. are this year adding to their fleet engaged in the mail and passenger services between the United Kingdom and South Africa. The building of these two vessels marks an important new departure in the history of the Castle Company, for they are the first of the twin-screw type ordered by Sir Donald Currie & Co., the managers, and they are moreover by far the largest steamers that have been constructed for this popular line. The *Kildonan Castle* is built with a straight stem and elliptical stern, a long forecastle, and poop, also a lofty promenade deck with boat deck above. Over this are a navigating deck and a flying bridge. Under the promenade and boat decks are central houses, leaving an open passage at the ship's sides, and above the boat deck provision is made for carrying the lifeboats. The vessel is built of steel throughout to the requirements of the Board of Trade for a foreign-going passenger steamer, also under special survey and with scantlings, as required by Lloyd's latest rules for the 100 A1 class. A cellular double-bottom is fitted the full length of the ship, and the holds are subdivided into separate compartments by watertight bulkheads, which are arranged and constructed so as to meet the recommendations of the Bulkhead Committee, with a double collision bulkhead fitted forward All the decks are plated, and sheathed with teak The *Kildonan Castle* will have two large elliptical funnels and three raking pole masts, fore-and-aft schooner rigged. Her dimensions are as follows:—Length, overall, 532 ft. 3 in.; Length, on water line, 515 ft.; breadth, extreme, 59 ft. 3 in.; depth, moulded, 38 ft. 9 in. The gross tonnage of the vessel is about 10,000, and the I.H P about 10,500. When completed the *Kildonan Castle* will contain accommodation for about 300 first-class passengers, berthed amidships, 160 second-class berthed aft, and about 200 third-class berthed forward. The state-room accommodation is of a lofty and commodious description, principally arranged on the main upper and promenade decks. On these are several single-berth state-rooms, but the greater portion of the cabins have two berths each, while there are a few family cabins. The sleeping beds are made to fold up, and will have Zephyr spring mattresses. Many of them are of double breadth. The main entrance is in the middle of the vessel, and leads direct to first-class dining saloon, a capacious room situated on the upper deck amidships. The sanitary accommodation and lavatories throughout the vessel have received special consideration, and are of the latest and most improved description. The ventilation has been carefully studied and a most complete system adopted. Electricity is brought to bear in ventilating the saloons, corridors, and sleeping cabins in between decks, by means of motor-driven fans. A continuous water service will be supplied throughout the ship. A complete installation of electric light is being arranged on board, the generating plant consisting of three independent sets of engines and dynamos. Electric bells will be fitted to the sleeping cabins and saloons. The cargo hatches will be equipped with nine steam winches for the rapid handling of cargo, an additional steam winch being also fitted for the purpose of hoisting the boats, of which 16 are provided. In addition, a full outfit of life-saving appliances, among them a number of buoyant life-jackets, have been supplied, and all other details required by the Board of Trade Passengers' Act. The steam-steering engine is placed aft on the poop deck, enclosed in a house, and controlled from the navigating bridge, also the reserve hand gear and steering wheels. A large steam windlass with frictional brakes and capstan will be fitted on the forecastle deck, adapted for the cables, which are 2⅞ in. in diameter. There are four heavy anchors made of nickel steel and of the patent stockless pattern. Two powerful steam warping capstans, with separate engines, are placed on the poop deck. In order to minimise rolling, deep plate bilge keels are fitted, and these with the centre bar keel—having together a side area of 750 sq. ft.—will ensure greater comfort for passengers by reducing very considerably the angle of roll in bad weather. The propelling machinery of the *Kildonan Castle* consists of two sets of four-cylinder, four-crank quadruple expansion engines, balanced on the Yarrow-Schlick-Tweedy system. It is claimed for this type of machinery that with a boiler pressure of 210 lb. per square inch, it ensures great economy of fuel, combined with minimum vibration of the ship. The engines are designed to run at a high piston speed with large bearing surfaces and comparatively light reciprocating parts. The shafting is of Whitworth steel throughout, and the working parts are forged from ingot steel, the principal bolts being specially annealed. The main condensers of galvanised steel plate are elliptical in section. They are placed close to the ship's side, and do not form part of the framing of the engines. In this and several other respects the machinery compares favourably, as regards weight, with the type of engine usually fitted in mail steamers. The pistons are of Whitworth steel, and, to carry out the balancing of the engines as accurately as possible, they were turned down to the correct weight after the other reciprocating parts were finished and weighed. The propellers are of bronze, with cast steel bosses. Every care has been taken to combine with the highest class of material and workmanship all details which experience has proved to be necessary to obtain freedom from breakdown on a long ocean run. Two powerful independent centrifugal pumping engines are fitted in the engine-room, and are so arranged that both main condensers can be circulated by either pump in the event of a breakdown of the other. Each of these pumps has a special bilge suction connection, so that in the event of a serious leak above the double bottom, both can be used for pumping out the ship. The discharges from these and all other pumps are below the water-line. to avoid spray being carried into the state room side ports. Three large steam pumps are fitted specially for hot bath, cold bath, sanitary, and fire service purposes. The fire service mains from these pumps are carried right fore and aft on the weather deck, and also in the passenger 'tween decks, with connection for hose at the necessary points. Very special plant is provided, entirely in duplicate, for evaporation and distillation. The total output of pure cool drinking water from this installation is 13,000 gallons per day. Combined with the fresh water supply throughout the ship there is a complete installation of filters. For the refrigeration of ship's provisions and the carrying of fruit or other cargo, a powerful duplex CO_2 machine is fitted in combination with six large insulated cold chambers. The electric light and power installation is on a considerable scale. In addition to nearly 1,000 lights in the ship, there are 23 motor driven blowing and exhausting fans (20 of which are each capable of passing 3,400 cubic ft. of air per minute) for sending air down to the engine-room and stokeholds, and for extracting vitiated air from the passenger 'tween decks. Electric lifts are employed for hoisting ashes in port when the hydro-pneumatic ejectors are not in use. For signalling in a fog an electrically controlled steam whistle is fitted, which is automatically sounded at the required intervals of time by a clock control. For communicating between the navigating bridge and the engine-room and other parts of the ship, loud-speaking telephones are fitted. Lady Tennant, wife of Sir David Tennant, the Agent-General for Cape Colony, performed the launching ceremony. As the big ship began to slip slowly down the ways she was christened *Kildonan Castle* by three of Sir Donald Currie's granddaughters. The huge hull took the water in splendid fashion, and was afterwards towed round to the Fairfield Co.'s dock, where she will receive her machinery, and be otherwise equipped for sea. After the launch the Fairfield Co. entértained a large number of invited guests at luncheon.

Tyrie.—On August 23rd a screw steam trawler, named the *Tyrie*, was launched from the yard of Messrs. J. Duthie & Co., Montrose. The vessel is the last of three built for the Fraserburgh and North of Scotland Steam Fishing Co., Limited. She is 119 ft. long, 21 ft. broad, and 12. ft deep. She will be fitted with triple expansion engines.

Insizwa.—On August 23rd Messrs. Hall, Russell & Co. Limited, launched at Aberdeen, the *Insizwa*, a steel screw passenger and cargo steamer, built to the order of Messrs. John T. Rennie, Sons, & Co., of Aberdeen and London, for their direct line of vessels between London and Natal. The dimensions of the vessel are:—Length over all, 342 ft.; breadth, 42 ft.; depth, 28 ft.; and about 3,000 tons gross register. The vessel is of the spar-deck type, with promenade deck aft, long bridge, and topgallant forecastle, flat plate-keel, and water ballast in cellular double bottom. The steamer is constructed to class 100 A1 at Lloyd's and has all the modern requirements to pass the Board of Trade. She will have a very complete outfit of navigating instruments, including two of Lord Kelvin's patent compasses and sounding machines. An installation of electric light, bells, &c., is being fitted up by Messrs. Claude Hamilton, Limited, Glasgow. The *Insizwa's* engines are triple-expansion of the most modern type, constructed by the builders, having cylinders 25½ in., 40½ in., and 69 in. by 45 in. stroke, capable of developing 3,000 I.H.P.

Papaloa.—On August 23rd Messrs. William Denny & Bros. launched at Dumbarton a fine twin-screw steamship which has been built to the order of the New Zealand Shipping Co. She is a sister ship to the *Papanui*, built for the same company by the Messrs. Denny and delivered towards the end of last year, and has been constructed to the British Corporation requirements. Her principal dimensions are 430 ft. by 54 ft. by 33 ft. She is to be engaged in the frozen meat trade between New Zealand and the home country. Accommodation is to be provided for 40 first and 40 second-class passengers, whilst space is also to be reserved for a number of third-class passengers. The refrigerating plant is that of the Linde British Refrigeration Co., Limited, of London. The furnishing of the vessel generally has been carried out in hardwood, and everything will be finished in a most complete manner. The engines, which are being supplied by Messrs. Denny & Co., are of the direct-acting tri-compound twin-screw pattern, with inverted cylinders. The diameters of the cylinders are 22 in., 35½ in., and 58 in. by 48 in. stroke. The vessel is to carry 8,000 tons of deadweight, all told, with a draught of 25½ ft. The christening ceremony was gracefully performed by Miss Mirabeau, daughter of Mr. Paul Mirabeau, of the Chargeur Rennis Shipping Co., of France, who named the vessel *Papaioa*.

TRIAL TRIPS.

Saxon Prince.—On July 21st the steamer *Saxon Prince* left the shipbuilding yard of Messrs. Short Brothers for her trial trip, which proved in every way satisfactory. Afteradjusting compasses, a series of runs was made over the measured mile, and a mean speed of 13 knots was attained. The vessel (of which we gave full particulars in our Launch columns, June issue, page 135) has a large deadweight and carrying capacity. special attention having been given to the arrangement of the upper and main decks to enable a large number of cattle to be carried. After the trial trip the vessel proceeded to Antwerp to load a general cargo.

Jokai.—On July 22nd the new steel screw steamer *Jokai* left the Tyne for her official loaded trial trip. She has been constructed by Messrs. R. Craggs & Sons, Middlesbrough, for the Royal Hungarian Sea Navigation Adria Co., Limited, of Fiume (of which we gave particulars in our Launch columns, May issue, page 89), for whom they have two duplicate vessels in hand. The main engines for this and the other two vessels under construction are by the North Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, and consist of a set of triple-expansion engines with cylinders 21 in., 37 in., and 62 in. in diameter, with 42 in. stroke, steam being supplied by two large steel boilers working at 200 lbs. pressure. On trial both ship and machinery proved satisfactory, the vessel attaining a speed of over 11 knots.

Hugin.—On July 24th the new steamer *Hugin*, built by Messrs. Wood, Skinner & Co., Limited, Bill Quay, for Messrs. Bruusgaard, Kjosterud & Co., Dram (of which we gave full particulars in our Launch columns, July issue, page 171), left the Tyne for her trial trip. On the completion of the trial, which was most satisfactory in every respect, the vessel proceeded to Blyth to load.

Grosmont.—On July 25th the s.s. *Grosmont*, recently built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. Gladstone & Co., West Hartlepool (of which we gave full particulars in our Launch columns, August issue, page 233), made her official trial trip in the Tees Bay, when an average speed of about 11½ knots was made. The trip was satisfactory in every respect. The vessel has been built under the supervision of Mr. C. Brockett, the owners' superintendent surveyor, who was present at the trial trip, and was highly pleased with the results. The builders were represented by Mr. L. Ropner. After the adjustment of compasses, the steamer proceeded on her run round to Cardiff, where she will load for Ceylon.

Mavisbrook.—On July 25th the fine steel screw-steamer *Mavisbrook*, built by Messrs. William Gray & Co., Limited, to the order of Messrs. Miller & Richards, of Glasgow (of which we gave full particulars in our Launch columns, August issue, page 233) was taken to sea for her trial trip, the results of which were perfectly satisfactory both as regard the vessel and her machinery, an average speed of 11 knots being recorded, and the machinery running without the slightest hitch. On the conclusion of the trial the *Mavisbrook* was headed for the Tyne, where she takes in her first cargo.

Steam Launch.—On July 28th the Lytham Shipbuilding Co. took out for speed trials a twin-screw launch of the following dimensions:—Length, 81 ft.; beam, 16 ft. 6 in.; depth, 5 ft.; built to the designs and under the superintendence of Messrs. Flannery, Fritton & Given, of Liverpool and London, to the order of the Egyptian Delta Light Railways, Limited, for service on the Nile. She is built of galvanised steel with wooden deck, and made in three sections for purposes of transport. Forward of the machinery is a large roomy saloon panelled in teak and fitted with two companions, as well as a skylight, and large square portholes, which make it eminently suitable for the warm climate. The draught of the vessel was 2 ft. 3 in. mean, and the mean speed obtained was 11½ knots. The machinery ran well throughout the trials, and the vessel proved herself in excess of the contract both as regards speed and lightness of draught.

Harburg.—On July 29th this steamer, built by the Flensburg Shipbuilding Co., for the Deutsch-Australische Dampfschiffs-Gesellschaft, went down the Flensburg Harbour on her official trial trip. She is a spar-deck boat 390 ft. long by 48 ft. beam by 31 ft. depth, moulded, with long poop and topgallant forecastle, and accommodation in deck-houses on top of poop amidships. She will carry 6,500 tons deadweight on Lloyd's summer freeboard, and is intended for the Australian trade. The arrangements for handling cargo are of the most complete description. The engines, of 2,500 H.P., gave the vessel an average speed of 13 knots. The trial was in every way successful.

Elswick Park.—On Wednesday, August 2nd, this fine steel screw steamer, built by Messrs. William Gray & Co., Limited, went on her trial trip. She has been built to the order of the Elswick Park Steamship Co., Limited, Newcastle (Messrs. Weidner, Hopkins & Co., managers), (of which we gave full particulars in our Launch columns, July issue, page 173). The trial was in every way satisfactory, and there was a large party of visitors on board. The steamer averaged 11¼ knots on trial, and then proceeded on her voyage to Galveston to load cotton.

Beta.—On August 2nd Messrs. William Gray & Co., Limited, sent to sea the s.s. *Beta*, which they have built for Mr. B. J. Van Hengel, of Amsterdam (of which we gave full particulars in our Launch columns, July issue, page 170). There were present on the trial trip, which was a most satisfactory one, Mr. Van Hengel, Captain Decher, Mr. Lotinga (the owner's representative in West Hartlepool), Mr. Lotinga, jun., and Miss Lotinga, Mr. Hessler, Mr. Assman, Miss Hallass. Captain Murrell represented the builders on the trial.

Ormley.—On Wednesday, August 2nd, the large steel screw steamer *Ormley*, built by Messrs. Craig, Taylor & Co., Thornaby-on-Tees, to the order of the North of Ireland Steamship Co., Limited, Belfast (Mr. W. R. Rea, manager), (of which we gave full particulars in our Launch columns, July issue, page 172), left Stockton for her trial trip in the Tees Bay. The engines gave entire satisfaction, a speed of 11½ knots being easily maintained, Mr. Rea and Mr. Joseph Lewis (superintendent engineer) expressing themselves as highly pleased with both the ship and engines. She carries a deadweight of over 7,000 tons. After the trial trip, the vessel proceeded direct to Cardiff, under the command of Captain Webber.

Greta.—On August 4th the trial trip of the steam trawler *Greta* took place, and proved highly satisfactory, a speed of about 10 knots being attained. The vessel was launched for Hull owners by the Irvine Shipbuilding and Engineering Co., Limited, Irvine, and is equipped with all the latest appliances for the North Sea fishery. Her dimensions are 105 ft. by 21 ft. by 11 ft. moulded, and the engines, which were supplied by Messrs. Muir & Houston, Limited, Glasgow, are of the triple-expansion type, having cylinders 10 in., 16 in., and 27 in. in diameter by 20-in. stroke.

Mingary.—On August 4th the new steam yacht *Mingary*, built by the Ailsa Shipbuilding Co., from designs by Mr. G. L. Watson, for Mr. Charles D. Rudd, of Shielbride, by Fort-William, ran her official trials on the Firth of Clyde. The machinery, which is of the triple-expansion type, by Messrs. Dunsmuir & Jackson, Govan, worked with great smoothness and steadiness, and a mean speed of over 13 knots per hour was attained on the four continuous double runs between the Cloch and Cumbrae Lights, being fully a knot per hour over the contract speed. The yacht was in every way thoroughly tested, and the results attained gave the utmost satisfaction to the owners' representatives and the party on board.

Somerford.—Messrs. Speeding, Marshall & Co., of Sunderland, have added another vessel to their fleet, viz., the screw steamer *Somerford*, built by the Blyth Shipbuilding Co., Limited, of Blyth (of which we gave full particulars in our Launch columns, August issue, page 233). This vessel was taken to sea on Saturday, August 5th, for the usual trial of speed, there being on board a large company, including representatives from the owners, builders, and engineers, who were all highly satisfied with the results of the trip. After the trial the ship was taken to the Tyne, where she will load and proceed to Cronstadt, under the command of Captain Clark.

Kumara.—On August 5th the trial trip of the finely modelled New Zealand screw steamer *Kumara*—which has been built to the order of the Shaw, Savill and Albion Co., Limited, of London, by Messrs. C. S. Swan & Hunter, Limited, of Wallsend, and fitted with machinery by the Central Marine Engine Works, West Hartlepool (of which we gave full particulars in our Launch columns, June issue, page 134)—took place. This vessel is the third which has been engined by the Central Marine Engine Works, and the fifth built by Messrs. Swan & Hunter for the Shaw, Savill & Albion Co., and is expected to keep up the high reputation for regular working and economy which has been previously attained. During the building the construction of the hull has been superintended by Captain McKirdy and Captain Scotland, and the machinery by Mr. C. T. Young and Mr. G. Adams, on behalf of the Shaw Savill Co. These gentlemen, together with Mr. W. C. Borrowman on behalf of the engine builders, and Mr. C. S. Swan, representing the shipbuilders, were present on the trial trip, the vessel leaving the Central Marine Quay at 3 o'clock for the Tyne. As there was no cargo nor bunkers on board, the trial was not an exhaustive one, but the machinery ran to the satisfaction of all concerned, and the vessel passed into the Albert Edward Dock to receive bunker coals, and make final preparations for the voyage to London, where she will load cargo for New Zealand.

Lord Ormonde.—On August 11th the new steamer *Lord Ormonde*, constructed by Messrs. William Dobson & Co., of Walker-on-Tyne, for the Irish Shipowners' Co., Limited, of Belfast, with engines by Messrs. John Dickinson & Sons, Limited, of Sunderland (of which we gave particulars in our Launch columns, August issue, page 234), was taken to sea, and had several runs over the measured mile, obtaining a speed of 12 knots per hour. Mr. T. R. Dixon, representing the owners, expressed himself highly satisfied with the trial, and the vessel sailed for Baltimore.

Volund.—On August 12th the steel cargo steamer *Volund*, built by the Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, went on her trial trip. She has been built to the order of Messrs. O. & A. Irgens, Bergen, and to Norwegian Veritas, highest class. The vessel is of the following dimensions:—Length, extreme, 245 ft.; breadth, 32 ft.; depth, moulded, 16 ft. 1 in. She is 1,085 brutto register tons. The engines are of the triple-expansion type, about 630 I.H.P., and the average speed is 10½ knots. The ship has a steel deck, double bottom for ballast, peak tank abaft, and is specially built for the timber trade. She is well fitted out in every way, having Emerson Walker's patent steam anchor windlass, Fisher's patent steam-steering gear, Bower's patent rapid-closing apparatus for stop valve—worked from bridge as well as engine-room—Bower's patent protection box for propeller shaft, three steam winches, and large donkey-boiler. The vessel and her machinery have been built under the superintendence of Mr. C. Dahm, Bergen. There were present on her trial trip the managing owners Messrs. O. & A. Irgens, and a large company of ladies and gentlemen. The trial was in every way a complete success.

Garonne.—On August 14th the fine steel screw steamer, *Garonne*, recently launched from the shipbuilding yard of Messrs. Robert Stephenson & Co., Limited, Hebburn-on-Tyne, to the order of the United Steamship Co., of Copenhagen, was taken out to sea on her official trial trip. The ship, which has been built to the highest class in the Bureau Veritas registry, is a fine type of the modern well-deck cargo steamer. Her dimensions are 250 ft. between perpendiculars by 35 ft. breadth, moulded, by 18 ft. 4 in. depth, moulded; and carries a deadweight of about 1,870 tons on her winter freeboard. She is for trading between the Baltic and the French wine ports, and has steel 'tween decks specially strengthened to carry wine. She is fitted with water ballast in double bottom, all fore and aft, and also in the after peak. The cargo arrangements are very complete. She has four steam winches, steam windlass, steam and hand steering gear, and patent anchors. The crew are berthed in the topgallant forecastle, and the accommodation for officers, engineers, saloon, and spare stateroom is in an upper bridge on the top of main bridge, and all accommodation is heated by steam. The engines—which are of the triple-expansion type with cylinders 19½ in. by 32½ in. by 54 in. by 36 in. stroke, supplied with steam from two main boilers, working at 180 lbs.—were also supplied by the builders. The trial was very successful, a mean speed of 10½ knots on the mile being attained, and the coal consumption worked out at a very low figure. Amongst the guests on board were Captain Hein, director of the United Steamship Co., and Captain Rabe, who has superintended the construction of the hull; and Mr. Fricke, who has superintended the construction of machinery; also Mr. Truxen, ship surveyor; and Mr. Wilson, engine surveyor of Bureau Veritas. The builders were represented on board by Mr. Walker, general manager; Mr. Campbell, Mr. Crow, and Mr. Stafford. After the trial, which was a loaded one, the ship proceeded to the Baltic with her cargo. The *Garonne* is the first of two steamers the builders are supplying to the United Steamship Co., Limited, and is the 130th steamer belonging to this company.

Duke of Rothesay.—On August 14th the large steamer *Duke of Rothesay*, built by the Caledon Shipbuilding and Engineering Co., Limited, at Dundee, for the Dublin and Glasgow Steam

Packet Co. (the Duke Line) for their cross-Channel service (of which we gave particulars in our Launch columns, July issue, page 175), made a successful trial trip.

Imperial Prince.—On August 14th the *Imperial Prince*, steel trawler, had a successful trial off the Northumberland coast, the speed attained being a mean of 10 knots. The *Imperial Prince* is the fifth of six sister boats constructed by Messrs. J. T. Eltringham & Co., and engined by Mr. G. T. Grey, South Shields, to the order of Mr. W. H. Storey, North Shields.

Bavarian.—On August 18th the twin-screw steamer *Bavarian* built by Messrs. Denny & Bros., Dumbarton, for Messrs. James and Alexander Allen (of which we gave full particulars in our Launch columns, June issue, page 137) ran her official trials on the Firth of Clyde, which consisted of several runs over the measured mile at Skelmorlie and a cruise down the firth. The machinery worked as perfectly as possible, and the mean speed attained was 17·95 knots, almost a knot over that required by the contract.

South Australia.—On August 22nd the screw steamer *South Australia*, recently launched from the shipbuilding yard of Messrs. Short Brothers, to the order of the Southern Steam Shipping Co., Limited, of London. of which Messrs. Lawther, Latta & Co. are the managers (of which we gave full particulars in our Launch columns, August issue, page 234), went out on trial with very satisfactory results. After adjusting compasses the vessel was taken a series of runs over the measured mile when a mean speed of 13 knots was attained. After the trial the vessel proceeded to Middlesbrough, under the command of Captain Barnes, where she loads for the Cape and Australia.

Eastham.—Lately a new and powerful steam tug has been delivered to the Manchester Ship Canal Co. by the builders, Messrs. Fay & Co., of Southampton. She is named the *Eastham*, and is a valuable addition to the company's fleet. She is 80 ft. long, 20 ft. broad, and has a draught of about 10½ ft. Her engines are about 500 I.H.P., and she is capable of towing the largest ships using the canal.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.

July 22nd, 1899.	Agate, Chas.	Ex.	1C	London
,, ,, ,,	Bryce, Wm. A.. ..	Ex.	1C	Liverpool
,, ,, ,,	Leblique, Louis J...	Ex.	1C	London
,, ,, ,,	Malcolm, M.	Ex.	1C	,,
,, ,, ,,	Phillips, Wm. T. ..	Ex.	1C	Liverpool
,, ,, ,,	Prockter, G. H. ..	Ex.	1C	,,
,, ,, ,,	Rioch, Robert J. ..	Ex.	1C	N. Shields

NOTE.—1C denotes First Class; 2C Second Class.

July 22nd, 1899.

Allan, James D.	2C	Dundee
Anderson, E. H.	1C	WHrtlepl
Barr, John T...	1C	Glasgow
Battey, Robt. F.	1C	,,
Boyst, Stephen	2C	Liverpool
Brownlee, T. M.	1C	WHrtlepl
Campbell, C. E.	2C	Liverpool
Carrel, John P.	2C	Cardiff
Cartlidge, L. I.	1C	London
Cavens, Wm ...	2C	Glasgow
Chamberlain, S.	1C	Liverpool
Clune, Joseph..	2C	,,
Colpitts, Jno. W.	2C	WHrtlepl
Cronin, Jas. S.	2C	Liverpool
Doyle, William	2C	,,
Dunn, Thos. E.	1C	N.Shields
Dykes, Alex. ..	1C	Glasgow
Eden, E. W. B.	1C	WHrtlepl
Gammage, W...	2C	Cardiff
Henderson, Ed.	2C	Dundee
Hughes, Robert	2C	Glasgow
Jones, Chas. J .	1C	Liverpool
Lindsay, W. F.	1C	Glasgow
Maclea, James...	2C	,,
Marshall, F....	1C	,,
Mauley, T. C...	1C	Plymth
M'Call, Wm. B.	1C	London
M'Candlish, N. K.	2C	Glasgow
Millican, A. E.	2C	N.Shields
M'Kenzie, Mat.	2C	London
Morinan, J. H.	2C	Cardiff
Morris, Hy. W.	1C	Liverpool
Morris, Wm. M.	1C	Dundee
Munro, C. W...	2C	Glasgow
Murray, Wm...	2C	Dundee
Parry, Chas. P.	2C	Liverpool
Platon, E. J. ..	1C	Cardiff
Pollock, J. R. ..	1C	Liverpool
Ratcliffe, W. S.	2C	London
Ridler, H. E. ..	2C	,,
Roberts, D. R..	2C	,,
Sanderson, W.	1C	WHrtlepl
Smith, David ..	1C	Dundee
Stewart, James	2C	Glasgow
Turner, A. J. ..	2C	Cardiff
Watson, S H...	2C	WHrtlepl
Watson, Victor	2C	Sthmptn
Welsh, Thomas	1C	Glasgow
Wilson, John H.	2C	,,
Wishart, George	2C	Liverpool

July 29th.

Anderson, S. A.	2C	N.Shields
Barrass, Jas. W.	1C	Sundrlnd
Chapman, J. J.	2C	Hull
Clark, Frank B.	2C	Liverpool
Dale, James M.	1C	London
Eggleston, S. ..	1C	Sundrlnd
Emslie, James	1C	Aberdeen
Gibbs, H. E. ..	1C	London
Gillies, Duncan	2C	Aberdeen
Gray, Wm. J...	1C	,,
Guilliland, Wm.	1C	Liverpool
Halffman, E. ..	2C	London
Hudson, Geo. C.	1C	,,
Inglis, Jas.	1C	Liverpool
Johns, H. W. ..	2C	,,
Lowe, Wm. H.	2C	N.Shields
Martin, Geo. A.	2C	Hull
Murison, John..	1C	Aberdeen
Penny, Robert	2C	,,
Roberts, Christr.	2C	London
Robinson, A. ..	1C	Liverpool
Skelton, John C.	1C	London
Stewart, Alex. G.	2C	Aberdeen
Turnbull. J. P.	2C	Liverpool
Williams, Peter	1C	N.Shields
Young, Geo. V.	1C	London

August 5th.

Abraham, J. R.	2C	Cardiff
Anderson, A. G.	1C	N.Shields
Atkins, Geo. W.	1C	London
Baltazar, Leone	1C	,,
Bates, Thos. E..	2C	N.Shields
Boase, Thos. A.	1C	Cardiff
Boyes, Wm. J..	1C	London
Brazendale, W. H	1C	Liverpool
Campbell, Hugh	2C	,,
Campbell, Jas..	2C	Sthmpton
Campbell, M. L.	1C	Cardiff
Clark, Gilbert E.	1C	Liverpool
Clark, Robert ..	1C	,,
Couch, Wm....	1C	Cardiff
Dadswell, John..	2C	London
Dick, Adam M'I.	2C	Glasgow
Dinning, H. N..	2C	N.Shields
Drennan, Robt.	2C	Glasgow
Ferguson, A....	1C	,,
Flood, Samuel..	2C	Liverpool
Forster, Thomas	2C	N.Shields
Fox, Leonard M.	2C	Cardiff
Galloway, A. H.	2C	Liverpool
Graham, A. T..	2C	N.Shields
Grey, John T..	2C	,,
Grundell, Wm..	1C	Liverpool
Hall, Richard ..	1C	Liverpool
Ham, Edward..	2C	Belfast
Hast, George ..	2C	Cardiff
Hume, A. G. ..	1C	London
Hunter, John ..	2C	N.Shields
Johnson, H. M..	1C	Belfast
Jones, A. T. H.	1C	Liverpool
Jones, Samuel..	2C	Cardiff
Karajia, T. G .	2C	Liverpool
Kirkwood, Hugh	2C	Glasgow
Knox, Hugh....	1C	,,
Lacon, Geo.....	2C	N.Shields
Lochead, Geo. T.	2C	Liverpool
M'Arthur, David	1C	Glasgow
Millar, David ..	1C	,,
M'Intyre, W. A.	1C	,,
Patrick, J. M'V.	1C	Liverpool
Platt, James ..	2C	,,
Reid, James....	1C	,,
Reynolds, W. A.	1C	London
Stewart, Peter..	2C	Glasgow
Taylor, Allan ..	2C	,,
Thistlethwaite, A.	1C	N.Shields
Thompson, John	2C	,,
Wallace, William	1C	Glasgow
Williams, H. J.	2C	N Shields

August 12th.

Asquith, F. W..	2C	Hull
Bailey, William	1C	Liverpool
Booker, Robert..	2C	Hull
Brennan, R. H..	2C	Liverpool
Buchan, John R.	2C	Greenock
Burdes, T. W..	1C	N.Shields
Cairns, Basil C.	1C	Greenock
Carr, Wm. J....	1C	London
Copeman, Ernest	2C	N.Shields
Edwards, W. H.	2C	Liverpool
Flockhart, J. H.	2C	,,
Fuller, John J.	2C	Dublin
Gibson, Robt. T.	2C	Liverpool
Hanser, S. W..	2C	London
Harris, Stanley	2C	Liverpool
Hedworth, C. W.	2C	N.Shields
Hudson, John..	1C	,,
McCracken, G. G.	2C	Dublin
McDonald, Jas..	1C	N.Shields
McFarlane, Jas.	2C	Leith
McMillan, Peter	2C	Greenock
Moffat, William	2C	London
Morris, Joseph..	2C	N.Shields
Morrison, J. J..	1C	London
Parker, L......	1C	Hull
Paterson, Archd.	1C	Leith
Paxton, Wm. H.	2C	,,
Raeside, D. W..	2C	Greenock
Ramsay, Alex..	1C	Leith
Robertson, Jas.	2C	Liverpool
Robertson, J. G.	1C	Greenock
Roxhke, William	2C	N.Shields
Spare, Edwin ..	2C	London
Thompson, J. H.	1C	N.Shields
Thomson, G. S.	1C	Greenock
Townend, Sidney	2C	London
Weaver, C. A. E.	1C	,,
Weddell, Geo. Y.	1C	N.Shields
Wight, Ronald..	2C	Greenock

August 19th.

Anderson, J...	2C	Glasgow
Band, William	2C	N.Shields
Barbour, James	1C	Liverpool
Barclay, Thos.	2C	Glasgow
Bay, James ..	2C	,,
Black, Wm. H.	2C	Liverpool
Bowen, Thos. P.	1C	Cardiff
Cambitchy, P.	2C	Glasgow
Carvell C. W.	2C	N.Shields
Cook, Carl ..	2C	W.Hrtlepl
Cravos, F. A...	2C	Cardiff
Crooks, J. R...	1C	W.Hrtlepl
Givens, R. H...	1C	London
Glover, Thos ..	1C	,,
Godfree, H.....	2C	Cardiff
Hardy, James	1C	N.Shields
Howie, Wm. ..	2C	Glasgow
Imrie, G. W. ..	2C	N.Shields
Jones, G. D. ..	1C	Cardiff
Mack, A. B. ..	2C	N.Shields
Mair, W. H. ..	1C	Glasgow
Mathieson, J. ..	1C	,,
McCall, W.....	1C	,,
Meredith, W. S.	1C	Cardiff
Muir, John K.	2C	Glasgow
Napton, W. J. G.	2C	Cardiff
Newham, T. W.	2C	N.Shields
Nockolds, C. W.	2C	WHrtlepl
Oswald, J. H. ..	2C	,,
Paterson, B. ..	1C	Cardiff
Permain, C. H.	1C	London
Phelps, J. D. ..	1C	Cardiff
Phillips, O. H.	2C	,,
Pickering, J. W.	1C	Liverpool
Procter, H. R.	1C	Cardiff
Rapley, W. E.	1C	N.Shields
Sandford, E. A.	2C	London
Strickland, R...	2C	WHrtlepl
Taylor, W. F...	1C	Cardiff
Thistle, J. B. ..	2C	WHrtlepl
Watson, A. R.	1C	London
West, H. E. W.	1C	,,
Whitmore, J. ..	1C	,,
Wiltshire, W. G.	2C	,,
Williams, H. ..	2C	WHrtlepl
Young, W. H...	1C	N.Shields

The Marine Engineer.

LONDON, OCTOBER 1, 1899.

SELDOM has any body of men or association been favoured with so instructive and scientific a survey of a marvellous mechanical evolution as the Mechanical Science section of the British Association has received from its president, Sir William White. This communication is marked not only by the exhaustive knowledge of the author of the subject with which he deals—viz., steam navigation at high speeds, but it is probably rendered unique by the clear and simple analysis of the cogent reasons underlying the rapid series of evolutions that has taken place, and it affords also an ample apologia for the great increase in dimensions and displacement of ships both in the Navy and the commercial marine that has accompanied such evolution. At the same time, Sir William White points out that with the means at present in common use we are near the limits of over-sea speed when other controlling factors are considered: viz., in the commercial marine, Will it pay? and in the Navy, Will the cost be justified by the fighting power and efficiency? Looking at the results so far attained the following characteristics are noticeable:—1st, growth in dimensions and weights of ships and large increase in engine-power as speeds have been raised; 2nd, improvements in marine engineering accompanying increase of steam-pressure, economy of fuel, and reduction in the weight of propelling apparatus in proportion to the power developed; 3rd, improvements in the materials used in shipbuilding, better structural arrangements, relatively lighter hulls, and larger carrying power; 4th, improvements in form leading to diminished resistance and economy of power expended in propulsion. In Transatlantic traffic, in which the greatest evolution has taken place, speed has been increased from 8½ to 22½ knots, and the time on the voyage has been reduced to about 38 per cent. of what it was in 1840. Ships have been more than trebled in length, doubled in breadth, and increased tenfold in displacement. The engine-power has been made 40 times as great. The rate of coal consumption (measured per H.P. per hour) is now only about one-third of what it was in 1840. To drive 2,000 tons' weight across the Atlantic at a speed of 8½ knots, about 550 tons of coal were then burnt; now, to drive 20,000 tons across at 22 knots, about 3,000 tons of coal are burnt. With the low-pressure steam and heavy paddle engines of 1840, each ton weight of machinery, boilers, &c., produced only about 2 H.P. for continuous working at sea. With modern twin-screw engines and high-pressure steam, each ton weight of propelling apparatus produces from 6 to 7 H.P. Were modern engines proportionately as heavy as those in use 60 years ago, they would weigh about 14,000 tons, and machinery, boilers, and coals would exceed in weight the total weight of the *Campania* as she floats to-day. Increase of speed has, therefore, been dependent upon improvements in marine engineering; but it has also depended upon improved materials of construction. The use of wood for hulls imposed limits, that the use of iron, and later, steel, has removed. Considerable improvements in form favouring economy of propulsion have all aided to the same end, though these have sometimes to be waived for other considerations, such as stability and seaworthiness.

IN war-vessels the same evolution has been going on. Up to 1860 12 to 13 knots were considered sufficient, but this requirement has since steadily increased to 20 and 23 knots. This increase of speed has been accompanied by a considerable increase in size, not only because they are faster, but because they have greater powers of offence and defence, and possess greater coal endurance. The improvements in marine engineering and shipbuilding have tended to keep down this increase of dimensions consequent on increase in load carried, speed attained, and distance traversed. It is to be noted also that, large as are the dimensions and tonnage of modern battleships and cruisers, they are all smaller in length and displacement than the largest mercantile steamers. This is not always realised, as merchant steamers are ordinarily described by their registered tonnage, which is far less than their displacement. The increased dimensions of warships are also justified by their gain of economy in propulsion by such increase of dimensions, as for a speed of 20 knots the I.H.P. per ton of displacement is only 1·09 in a cruiser 500 ft. in length, as compared with 3·33 I.H.P. per ton of displacement for a cruiser only 280 ft. long. Similarly a cruiser 500 ft. long, with 14,200 tons displacement, requires only the same H.P. to drive her at 22 knots as does a cruiser 435 ft. long with 11,000 tons displacement. In the latter cruiser, therefore, we obtain a greater margin of coal endurance and powers for extra armament and armouring.

IN the case of torpedo-boats, which furnish some of the most notable examples extant of the attainment of extraordinarily high speeds for short periods and in smooth waters, by vessels of small dimensions, the law shown to hold good in larger vessels applies equally. In the development of speed from 18½ knots to 26 knots the weight has increased from 30 tons to 150 tons, and the length from 81 ft. to 150 ft. In destroyers also, which are not yet of seven years' standing, the evolution is also apparent. The first examples with 26 to 27 knots were 180 ft. long and of 240 tons. Vessels now in construction for 32 to 33 knots have lengths of about 230 ft. and weight of 360 to 380 tons. High-pressure steam, water-tube boilers at forced draught, and high speeds of engine-revolution are their characteristics. Each ton of propelling apparatus produces about 45 I.H.P., and this compares with about 12 I.H.P. per ton weight of propelling apparatus in a large modern cruiser also with water-tube boilers. In a destroyer nearly half the total weight is devoted to propelling apparatus as compared with 20 per cent. in a cruiser, resulting in extreme lightness of hull, scantling, and fittings for their power, which would not be favourable to endurance for ships of large size, and where high powers might be frequently or continuously required. Still, the results obtained in torpedo-vessels being so wide a departure from those of sea-going vessels may foreshadow an intermediate type of propelling apparatus applicable to large sea-going vessels, and yet securing sufficient durability and economy of fuel in association with further savings of weight.

The turbo-motor rotary engine of Mr. Charles Parsons reduces the weight of machinery shafting and propellers much below that of the reciprocating type. The *Turbinia*, 100 ft. long and only 44½ tons displacement, has attained 33 to 34 knots in short runs. There are three shafts, each carrying three propellers, making over 2,000 revolutions at full speed. A water-tube boiler of special design supplies steam at 175 lbs. pressure, and is exceptionally light, being highly forced. About 100 I.H.P. is produced per ton of propelling apparatus, which is rather more than twice that obtained from the best reciprocating machinery of torpedo-boats or destroyers. In the *Turbinia* about half the total weight is devoted to propelling apparatus. Two other vessels of the destroyer type with turbo-motors (one for the Royal Navy) are now approaching completion, and will serve as a comparison with similar boats driven by reciprocating engines. Mr. Parsons claims at least equality in coal consumption with the best triple-expansion engines. He has had to deal at the unusual speeds of revolution with completely new conditions for propellers, and has found a solution, apparently satisfactory, in multiple screws of small diameter. The new boats, developing, it is expected, up to 18,000 H.P., may produce, as a result, very far-reaching effects upon marine engineering construction.

Model experiments have a very considerable value in leading to deductions as to probable results in the driving of ships of large size at speeds much exceeding any of which there is present experience. Careful modern experiments have shown that Froude's simple ratio of the surface resistance of vessels varying directly as the square of the speed has now been corrected to a ratio of 1·83 power of the speed, which, though apparently a small correction, is of importance at high speeds. The laws of the variation of the residual, or wave-making, resistance may also largely differ from the same simple ratio. It has been found up to 11 knots to vary as the square of the speed, at 16 knots as the cube of the speed, and up to 20 at the 3·3 power. Then the index begins to diminish: at 22 it is 2·7; at 25 knots it has fallen to the square, and from there to 30 knots it varies, as practically does the frictional resistance. The higher increments of speed are therefore attained with less proportional resistance from this cause. In the largest cruisers the point of minimum index for wave resistance is not reached until 47½ knots, which is outside practical politics at present, and further present increase of speeds in cruisers and battleships must be faced with the highest index of increased wave resistance.

The possibilities of ocean navigation 60 years hence are impossible to predict; but, with regard to the near future, Sir William White considers that still further advance may be made upon the lines above indicated. If greater draughts of water can be made possible, so much the better for carrying power and speed. Scientific methods of procedure and the use of model experiments on ships and propellers will become of increased importance. Already avenues for further progress are being opened. Water-tube boilers have effected a saving of one-third of the weight necessary to obtain the same power with natural draught in the older cylindrical boilers. The best form of water-tube boiler has yet to be evolved. Differences of opinion exist as to probabilities of increased steam pressure. As a matter of course, increases of pressure beyond 160 lbs. to 180 lbs. cannot produce the same increase of economy as was found in the rise from low pressure to 180 lbs. Some do not favour a higher pressure than 250 lbs., others go to 300 lbs. The use of rotary engines, such as Mr. Parsons's turbo-motor, opens up great possibilities. Mr. Parsons believes he can halve the weights of engines, propeller, and shafting, with the same power as in present Atlantic liners; and this, effected in association with water-tube boilers, might revolutionise the design of this class of vessel, or permit great increase of speed with present dimensions. Liquid

E NEW
BLIC LI
OR, LENOX
TILDEN FOUNDA

fuel, if it could be obtained in sufficient quantities, appears to offer a possibility of at least 30 per cent. reduction in weight of fuel carried, which would amount to 1,000 tons in Atlantic liners. Alloys of steel with nickel now give a metal better than mild steel, with ample ductility. Possibly a deadweight of 1,000 tons could be saved in an Atlantic liner by the adoption of such alloy, if cost would permit. It must never be forgotten that as ships grow in size, speed, and cost, the responsibilities of those in charge increase. The engineer in charge must have great powers of organisation and good technical knowledge. The "human factor" is often forgotten, but is all important, and it is to be hoped as responsibilities increase men will be found to bear them.

THE MOSSBERG PATENT THRUST BEARING.

ALTHOUGH the anti-friction roller-bearing has been used so widely in some branches of manufacture, such as rolling mills, turbines, electric cars and worm gear, it is surprising that it has not made much progress in its application in marine engines. This is probably due to the heavy loads involved, difficulties in obtaining uniform bearing on all the elements of the roller system, and the question of ready access and simple adjustability as wear and tear occur. There is no possible doubt of the great benefit derived from such a roller system of bearing in an abstract sense, but its application has been met with considerable prejudice, particularly in connection with marine matters. One thing to bear in mind with this kind of bearing is that the pressure is transmitted by what may be termed line-contact, and in transmitting large pressures a sufficient lineal length of line-contact must be provided to ensure no crushing or deformation of the rollers when under pressure, as otherwise their life must be very short. Again, in the case of the pressure being in a direction parallel with the axis of revolution, in order to obtain true rolling contact the rollers must of necessity be conical, and the lateral component of the force resisting the end pressure has to be taken into account, and provision made for properly dealing with it.

We have on previous occasions dealt with this problem, and have illustrated and described some of the appliances which have been designed for this purpose, and have now the pleasure to deal with a device which is manufactured by the Mossberg Roller Bearings, Limited, of 6, Victoria Street, London, and Birmingham, at which latter place their works are situated.

In the adjoining illustration Fig. 1 shows the three parts forming the bearing separated from one another, viz., the thrust collar, the cage of rollers, and the thrust block. Fig. 2 is a sectional view of the parts in position. Fig. 3 shows a perspective view of a thrust block for a propeller shaft, the various parts being removed. Fig. 4 shows an application of the thrust bearing to a propeller shaft in place of the old style thrust block. Fig. 5 is a view of the bearing as applied to turbine wheels.

It will be seen from the illustration that the bearing consists of two circular parts with conical roller path, one of which is stationary, and forms the thrust block, and the other revolves with the shaft, and forms the thrust collar. Between these circular parts a cage is arranged carrying a number of conical rollers of such a form as to make true rolling contact with the conical paths. The rollers are held in the cage in such a way as to be retained in position. It will be seen from Fig. 3 that all the parts are made in halves, so as to be capable of being placed around the shaft and removed therefrom without disconnecting it in any way. The bearing shown in Fig. 5 has, we understand, been doing a heavy duty in a most satisfactory way, viz., supporting a shaft with a load of 20 tons, revolving 260 revolutions per minute.

As an interesting fact in reference to this bearing, we will record the results of a comparative test which

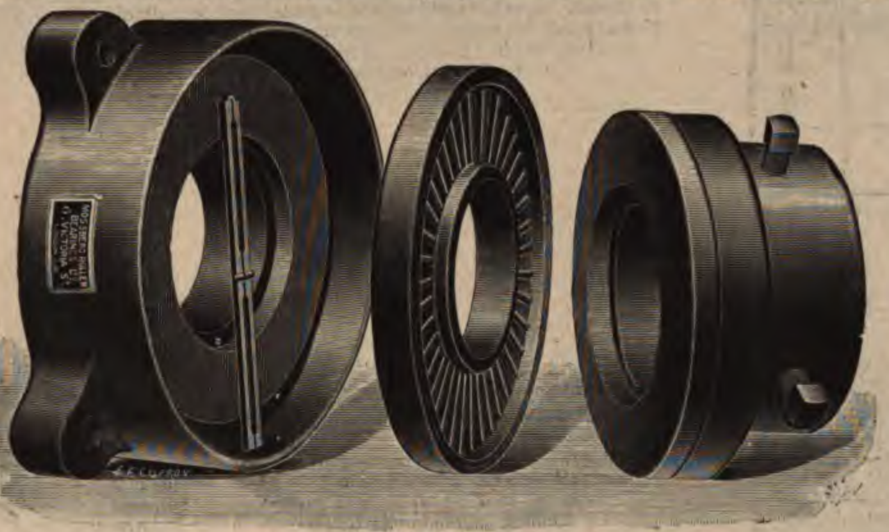


FIG. 1.

was made with it in conjunction with an ordinary plain footstep bearing. The load was 8,000 lbs. in each case, and the area of each bearing was 76 square inches, giving a load of about 104 lbs. per square inch of surface. A torsional pull was applied at a radius of 10½ in., and the pull to start motion in the case of the plain bearing was 400 lbs, and in the roller bearing only 20 lbs., giving a friction co-efficient of ·05 and ·0025 respectively. This, it will be readily conceded, is a remarkable result, and one which shows the subject is worthy of attention, as the reduction of thrust block friction to 1-20th on a large ocean liner must mean a considerable saving of power, and hence of coal.

From the copies of testimonials we have seen the question of the life of the bearing appears to be satisfactorily established, as some of them have run for three years continuously without any defect showing. It may be interesting to note, as bearing on the matter, that some of the electrical engineers are using these patent roller bearings to carry the main shaft in engine generators having flywheel armatures with excellent results.

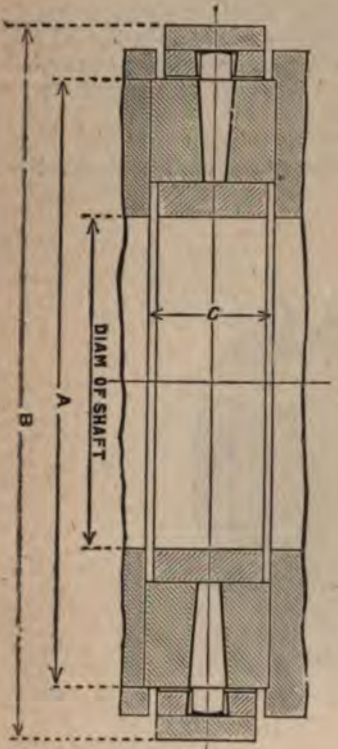


Fig. 2.

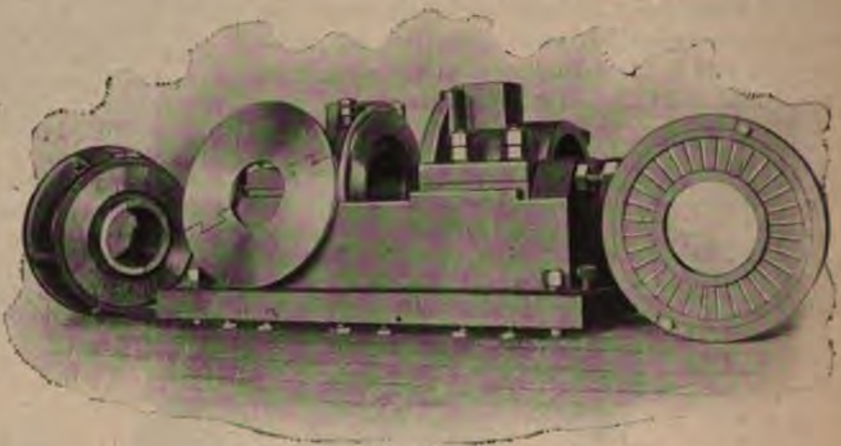


Fig. 3.

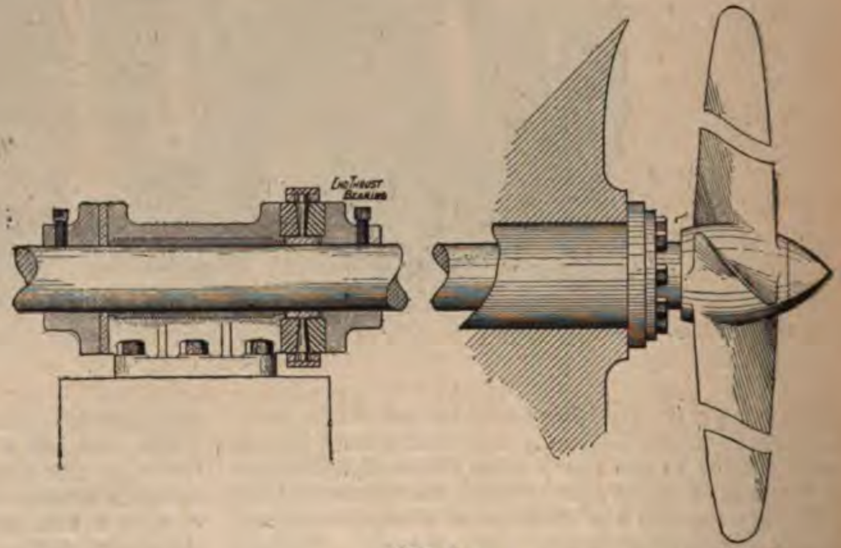


Fig. 4.

THE FLEETS OF THE MAIL LINES.

(*From our own Correspondent.*)

The Dangers of Deep-Draught Steamers

have recently been well exemplified by the experience of the Cunard cargo boat *Ultonia* This vessel, as may be remembered, left Boston for Liverpool on August 5th, but immediately after sailing she put back with serious leakage forward. She was temporarily repaired, but the damage she had sustained was so serious that it necessitated her missing her next westward sailing altogether, so that in the month of August, when things are good, the Cunard Company had to leave blank a Boston sailing each way. A careful survey of Boston Harbour has followed on this accident, and this has proved that the mishap occurred on an uncharted danger. The system of sounding the channels in Boston Harbour must have been very much neglected of recent years whilst important changes have been taking place, for the survey which followed the *Ultonia* accident revealed two other serious differences between the depths as shown in the chart and the actual amount of water existing. Needless to add, the differences are against the ship. By this means, however, the *Ultonia* will attain a fame which her size, speed, or accommodation will never earn for her.

Nevertheless, her reputation as a shoal-finder, however, will scarcely equal that of the steamship *Mameluke*, which in June, 1897, struck an uncharted danger in the Delaware when inward-bound to Philadelphia with a heavy cargo of ore, sustaining damage to the extent of £5,000 by the contact. A patch of rock and boulders was afterwards found at the place, and this was dignified with the name of the ship which had so unwittingly found it. The harbour authorities have now dredged the spot and made it safe for the passage of steamers drawing 26 ft. at any state of the tide. This has cost them about £14,000 sterling, but their work is by no means finished, for a depth of water of 26 ft. is not enough for the steamers of to-day. The new Leyland liner ***Winifredian*** had a draught of 31 ft. 8 in. when she sailed from Boston on her maiden trip, whilst 30 ft. is by no means unusual in vessels leaving New York. Even the port of Baltimore has touched this figure with the Hamburg-American steamship *Bengalia*.

A Reported New Cunarder.

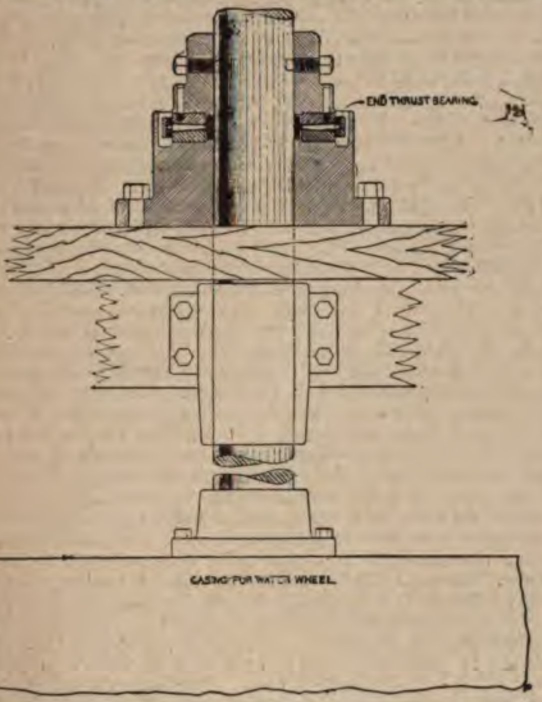


Fig. 5.

No sooner is the *Oceanic* started on her maiden trip than the rumour is circulated that a vessel greater even than the big White Star boat has been ordered by the Cunard Line. The report is circumstantial enough. We are told that she is to be 15 ft. longer than the *Oceanic*, and is to be constructed by the Clydebank Yard. Several points in this story seem to militate against its probability. Clydebank has not had orders from the premier Atlantic line since it turned out the *Servia* and *Aurania* for them in the early eighties. These vessels did not quite come up to the expectation of their owners—though the fault probably did not lie with those who built them—and it was to Fairfield that they next turned. Fairfield has given them two famous pairs of record-breakers in the *Umbria* and *Etruria* first, and afterwards in the *Campania* and *Lucania*, and one does not see any reason why custom should be withdrawn from them. The recent change at Clydebank, whereby Messrs. John Brown & Company, of Sheffield, have absorbed the old firm, does not suggest any solution of the mystery. Lastly, the time is by no means ripe for the placing of an order of the kind suggested. It is now too late to hope that a vessel could be got ready in time for the Paris Exhibition traffic of next year. So there is no immediate hurry. The present fleet is quite adequate to ordinary demands upon it, and in the ordinary course of events is likely to remain so for some little time; but, above all, there is the fact that in a few months there will be so much fresh experience available in regard to steamships of the biggest class. The *Oceanic* for one will, before a few months are passed, be able to give some valuable hints even to the rivals of her owners. The first of the new steamers of La Compagnie Générale Transatlantique is actually now in the water. The Vulcan Company at Stettin is progressing with its leviathans for the Hamburg-American and the Norddeutscher Lloyd. Everything is to be gained by postponing a move for the present. But though the rumour is improbable, it has not been denied. This may, perhaps, be accounted for by the fact that it is thought by some persons in any event not to be worth while correcting press rumours; whilst such a report is that at present flying about affords a good and gratuitous advertisement for the line which is fortunate enough to be credited with an intention which seems at least to be premature.

The Channel Islands Service.

An important announcement has been made by the two lines which so efficiently serve the Channel Islands. It is to the effect that from and after the 2nd October a working arrangement will be carried out between the hitherto bitter and keen rivals whereby great economies will be effected. Instead of a nightly departure by the South-Western boats from Southampton, and by the Great Western from Weymouth, each company will in future make but tri-weekly sailings at night. Though there will still be a sailing every night, it will be made alternately by the two companies, who will honour each other's return tickets. Provision will be made for day sailings also when needed. The agreement is an excellent one for all concerned. Its possibility has undoubtedly been brought about by the lamented accident to the *Stella*. That and certain previous occurrences had made it incumbent on the two lines to assure the public that there should in future be no room for any suggestion of racing between the two sets of steamers. The companies began their *rapprochement* by attempting to arrange for different hours of arrival. Having once got to discussion, they saw that the compromise might with advantage be carried still further. Passengers will lose little, if anything, by the arrangement—at all events during the winter season. The loss of the companies, which has ever been serious during all except the few months of the summer, will now be very largely reduced, if not actually turned into a profit.

The Gaspesia

even in her new career for her new owners seems not to have reached the end of her troubles. In September she loaded a cargo of deals for the United Kingdom at Bathurst—what a come-down for the vessel that but a year ago was by her own efforts going to put Milford in the place of Liverpool and Southampton, and herself in that of the *Lucania* and *Oceanic!* But she got into trouble off Singen, and, after anchoring in what was reported as a dangerous position, put into Sydney, Cape Breton, to repair her steering gear.

The Hamburg-American Line

has now got back into the position which it relinquished prior to the time of the Hispano-American war, and can once again make a weekly sailing to New York with a twin-screw express steamer. The *Columbia*, one of the two steamers disposed of to Spain, resumed work for her old owners at the beginning of September, and the Schichau-built *Kaiser Friedrich* is advertised to resume her interrupted sailings on the Atlantic, this time under the "flag of the Hamburg-American Line," to quote the words of the advertisements. She inaugurates her new career with a sailing on October 2nd.

The Norddeutscher-Lloyd

is inaugurating its improved service to China and Japan with the sailing of its fine new twin-screw liner *König Albrecht* on October 8th. The service will be continued fortnightly, and will, it is to be feared, make a keen competition keener for British shipowners. Such a vessel is, of course, far in advance of the legitimate requirements of the trade at present, and can only be placed in the service by high subsidies provided with the express intention of securing the future developments of the countries which are being opened up. The *König Albrecht* will be far the largest vessel ever seen in those seas, eclipsing even the British cruiser *Terrible* in her displacement. Her gross tonnage is over 10,000 tons. The Norddeutscher-Lloyd, which, as I mentioned last month, sent the *Werra* back to Bremen from Liverpool, have not long suffered her to remain in idleness. They have refitted and redecorated her, and are sending her out as an extra boat in the New York service on the 2nd October.

The Kaiser Wilhelm der Grosse

continues to do well. Leaving the Needles on her 21st trip at

1.58 p.m., and Cherbourg Breakwater at 6 p.m. on August 30th, she was off Sandy Hook Lightship at 7.15 a.m. on September 5th, having made her passage at a speed of 22·08 knots. The most remarkable thing about the details of this trip seems to be the uniformity of the daily runs. None of them were big for the vessel which made them, but they were all well together. Her run to noon on August 31st was 411 nautical miles; to noon on September 1st, 546 miles; to September 2nd, 546 miles again; September 3rd, 556 miles; to September 4th, 538 miles; and then, to Sandy Hook, in the early morning of the 5th, 452 miles; her total distance steamed therefore was 3,049 nautical miles. Thus, though this was her best run to the westward, her best day's steaming on the voyage was exactly a knot worse than that of the record day's steaming which she holds. Returning she passed Sandy Hook Lightship at 12.30 p.m. on September 12th, and was off Cherbourg Breakwater at 11.16 a.m. on the 18th. Her passage was thus five days 18 hours and six minutes, and her average speed 22·44 knots. Her time was therefore neither as good nor was her mean speed as high as her previous best. But again the running was singularly even. To noon on the 13th, in the broken day, she did 499 miles; then to the 14th 504 miles; to the 15th 517 miles; to the 16th 536 miles; to the 17th 530 miles; and to Cherbourg 503 miles, making a total distance steamed of 3,099 miles.

La Lorraine.

The new steamship of La Compagnie Générale Transatlantique was launched from the company's yard at Penhoet on the 20th September. She is the first of a pair of sisters now under construction. She is upwards of 500 ft. long, and over 60 ft. beam. Her gross tonnage will exceed 10,500 tons. She has the proud distinction of being the largest craft ever constructed in France. It is hoped that both she and her sister will be ready for the Paris Exhibition traffic of next year. With their new ship *L'Acquitaine*, formerly the *Normannia* of the Hamburg-American Line, *La Touraine*, which has already done good service for the French company, and the sister, which are now getting ready for service, a twin-screw weekly service will be within the power of this company next year.

The Castle Line.

I had the pleasure on the 22nd of August of seeing the *Kildonan Castle*, second of a pair of sisters launched from the Fairfield yard. As the new ship is fully described elsewhere, I must not dwell too long on her description save to say that she in every respect resembles her sister the *Kinfauns Castle*. The launch was remarkable for the fact that the good ship was released from the stocks not by one lady, but by three. A very pretty idea had occurred to Sir Donald Currie, chairman of the Castle Mail Packet Company, and Sir Donald's ideas generally prove valuable facts. He had the ship launched by three diminutive grand-daughters The launch was in every way successful, and after the usual hospitality with which Fairfield welcomes its guests, we went aboard the *Lucy Ashton* en route for the Tail of the Bank. Off Greenock there was a fine ship indeed awaiting us. The *Kinfauns Castle* with her 10,000 tons looked more like a magnificent yacht than a great ocean liner in the evening sun. It seemed almost incredible that but three months previously one had seen her sans fittings, sans engines, sans upper works, sans masts and funnels, put into the water as one had seen her younger sister earlier in the day. Yet in that brief space the hulk had been made a ship complete in every detail which the experience and foresight of those who have built up a great company could suggest. That night we lay at our anchors, and had a fine opportunity of seeing something of the arrangement and decoration of the inside of the ship. The midship dining saloon is on the upper deck. It is capable of seating nearly as many passengers as the ship can carry in her first-class. In point of fact, when allowance is made for those who take large rooms for a single person, and for the children, who have their own accommodation below (where seats that can be altered to suit the little passengers' dimensions are thoughtfully provided), the saloon gives ample room to seat every one at once. It is beautifully panelled in mahogany inlaid in the Chippendale style. The windows here, and elsewhere, are a feature of the ship. I say windows advisedly, for port-holes they cannot be called any more. They are rectangular, and so large that they have four panes of stout glass in each; but so stout is the glass and so solid the brass framework that there is no likelihood of any sea, even in the Bay of Biscay, injuring them. How they will be appreciated when the big ship gets into the tropics! In admiring the windows, however, the central shaft, or dome, must not be forgotten. It is large, but its art is so well disguised that its simplicity takes one's fancy at once. Its straight sides are ornamented in relief, and are coloured plain dead white. The only touch of gilding in the whole apartment is on a slight wrought-iron grill under the glass at the top of the dome. The effect is charming, so tasteful and so cool! Perhaps it is not out of place to explain my constant reversion to cool effects by saying that before I left the ship the August sun taught those who played cricket (with real bats and real wickets) on the promenade deck something of the heat which the good ship will meet with to the south of Madeira, and the extensive installation for ventilation and the great windows were fully appreciated by Sir Donald's guests in the Irish Sea. Leaving the saloon one comes into the main companion, and notices here a bold variation from what is considered the usual practice. The main staircase is a single stair all the way up—it does not bifurcate at the half landing into two narrower sets of stairs. The reason of this new departure is again to increase the possibility of air getting below. At the head of the stairs opening out of the main companion is the library, well furnished with well-bound books and writing tables. Through this we go to the drawing-room. Here, as throughout the ship, head room is afforded in plenty. The height at the sides is about 9 ft. 6 in., but in the centre the room rises to a height of nearly 14 ft. This great advantage has been attained in a simple manner and without in any way weakening the structure of the vessel. The raised portion of the central deckhouse—in which the drawing-room and certain other apartments are situated—comes up on to the navigation or boat-deck. The extra height is given by making the central part of this deck inside the passage ways, where those who use the deck go to and fro, of curved steel plates. The room which is especially associated with the ladies is beautifully inlaid with satin-wood and the furniture and silk hangings harmonise well. But the smoke-room is the gem of the ship. It, too, has the peculiar roof of which I have just spoken; but the decoration is perfect. The walls are panelled in oak with that dark green polish which is now so popular ashore. The central idea is to suggest an old Dutch interior, and the blue Delft tiles which are let into the walls bear it out well. These give representations of various buildings in South Africa and of the line's well-known steamship the *Dunottar Castle* in Table Bay. The ironwork of the doors and of the bar hatch, the electric light fittings, and every detail in the room give one the impression that many typical old Dutch interiors have been well studied by the designer. A commodious lavatory adjoins this room. On this deck, also under the shade of the boat-deck, are numerous deck staterooms. These, like the rooms on the main and saloon decks, are large, lofty, and well-fitted with conveniences in the way of chests of drawers and hanging cupboards. The second-class accommodation is such as is worthy of the ship. This dining saloon is panelled in oak, otherwise it would be hard to distinguish it from the first-class. The staterooms here and in the third-class are most inviting. The third-class passenger indeed finds his comfort in every way studied. But to return to the trip. On the Wednesday a large party came down in the morning aboard the *Lucy Ashton*, and then the ship started for a cruise to the Isle of Arran, showing her paces meanwhile. The absence of vibration was most remarkable now, thanks to the fact that the machinery, like that of recent vessels of the line, is on the four-crank quadruple-expansion principle, and balanced on the Yarrow-Tweedie-Schlick patent. The steam for the two sets of engines is supplied at 210 lbs. pressure. After a very enjoyable cruise, the party from Glasgow left us regretfully aboard the tender, and, reduced in number to little over a score, we put off to sea as the evening closed in. Next day (Thursday) as we ran down the Irish Sea we had a demonstration of the celerity with which the boats could be got out—if need be—under a new arrangement patented by one of the firm's employees, Mr. Meldrum. Up we went to the navigation-deck, where are the officers' quarters and the chart and steering rooms, and where the long rows of lifeboats lay on their metal chocks. The idea of the new invention is to avoid all difficulty and waste of time in tightening the falls of the boats by instantly taking up the slack when they come to be running out. The metal chocks can be let fall by knocking away short rods which support them, and then the boat stands on a short metal support at either end. A little steel block is then struck away, and a short piston, which carrie the support, is free to sink under the weight until the tightening falls relieve it of the pressure. All that has to be done by the two men, who are sufficient to get the boat out, is to angle her out through the davits. Several boats were dealt with during the demonstration, and it was seen that under half a minute was all the time that was needed. At 11 o'clock that evening the vessel, having been running steadily and easily at about 16 knots since leaving the Clyde, the Lizard Lights were seen; and next morning, when we had torn ourselves away from the shower-baths and sprays which are so liberally provided below, we found the ship manœuvring off Portland. The steering gear is of Brown's patent, worked by the telemotor from the bridge, and the steering engine is the largest of the type I have seen. When the helm was put hard over for circling, it was wonderful to remark how imperceptible was the shock given to the surrounding parts by the rush of the heavy engine on the end of the tiller. Thanks to her twin-screws and the Fairfield bow, the big ship proved most handy, and each circle made seemed smaller than the last. Early that afternoon we made Southampton, being followed up the water by the Hamburg-American liner *Augusta Victoria*, whose band very courteously saluted us with "God Save the Queen." All the answer our little company could make was a cheer, and cheer we did, too, our hail being swollen by the assistance of a number of stokers who had come up to have a look at the big German. In the afternoon we had the opportunity of going aboard the *Briton*, the premier boat of the Union Line, a vessel of just our own size, which lay next us at the quay. It was very remarkable to compare the work of the Irish and Scotch yards, and to see in what different ways two companies working the same trade elaborate details for the comfort of those whom they serve. Here, on Saturday morning, a number of us quitted the ship, being unable to complete the voyage to Tilbury, where the vessel docked on the Sunday. The Mayor and Corporation of Southampton and the members of the Chamber of Commerce were entertained to lunch ere the ship left Southampton. Doubtless they were as full of praise for the ship, and for the hospitality and kindness of Mr. Mirrilees, and of the constant attention of Mr. Matheson, as were the humbler guests who came round in the ship. That the vessel marks a distinct step in the development of the trade no one can deny. Apart from the fact that she brings Sir Donald Currie now into the growing camp of those who think duplication of machinery the right thing, she is so large and so entirely given up to passenger accommodation that it may be said that she offers those who go the long trip to the Cape a ship such as a few years ago could not have been even imagined for the most competitive trade in the world—that to New York, where, too, the distance to be traversed is but the half of the Cape voyage.

A New Company,

which may have an important influence on the future, is the Jamaica Produce and Fruit Company, Limited, which came before the public during the latter half of September. Its origin is due to the report of the West India Royal Commission, which sat a year or so ago, and which recommended the encouragement of fruit culture for the islands in the place of the bounty-killed cane sugar industry. Oranges and bananas are the fruits to whose supply and carriage the company looks in the first instance. Four steamers, costing about £80,000 apiece, are being built for the service on the Clyde. These are to be fitted with refrigerating apparatus for the perfect carriage of the fruit. They are to be delivered next April. The Government has guaranteed a subsidy equal to about three per cent. on the capital of the concern. It would appear that this money will be earned partly by the fruit-carrying business, and partly by the carriage of mails. Under this latter head it may be that the new comer will be a competitor with the West India Royal Mail Company. In this connection it must not be forgotten that the contract with the old company is about to come up for renewal. It is possible that the new line may take away the mail contract, and, if that be so, the prospect for those interested in the old company would be serious indeed.

The Carisbrook Castle,

of the Donald Currie Line, has just made a remarkable passage homewards, doing the run in 14½ days. She landed her mails on the Thursday night, instead of, as is usual with the best mail steamers, on the Saturday.

The City of Rome,

of the Anchor Line, on her outward trip ran on to an iceberg in a fog on the last day of August. No damage was done to the ship, but the newspapers have published a "graphic" account of the scene on board by one of the passengers. He makes out that a complete panic occurred. The incident was so void of dangerous results that no action seems to have fallen to the duty of the officers and crew. But they did not lose their heads to the extent which the passengers did, and the latter, conscious of the fact, offered a "petition of congratulation" to the master.

The Oceanic,

which I viewed in dock at Liverpool on the last day of August, has made an excellent maiden trip at 19·57 knots mean speed with about three quarters power. But I am dealing with the details of the big ship elsewhere in this issue.

The Exploitation of Southwold

seems to be the latest departure of the Belle Line of steamers and of its kindred undertaking, the East Coast Development Company. Southwold is to have a Belle steamer called after it. Messrs. Denny, of Dumbarton, have been entrusted with the task of constructing her, and she is to be an advance even upon the vessels that have already been put into the service. She will be ready for next season's traffic, and by that time the new pier at Southwold, which is to be about 700 ft. long, will be ready for her—and for the other vessels of the fleet—and a call will be made at the new resort on the Yarmouth voyage. Facilities for carriage and for landing are not quite all the holiday-maker desires. He must have a place to rest in. So the Grand Hotel, Southwold, is already showing itself above its foundations. The older resort of Walton is also being kept well up to date, a large pavilion being in course of construction on the pier, where owing to the services of the electric railway approach is at all times easy. The hotel here is to be enlarged, and a floral hall and winter garden constructed near the railway station. The season just concluded has seen the record to Yarmouth lowered by the *Yarmouth Belle*, she having reduced the passage from the company's berth off London Bridge to Yarmouth to nine hours, inclusive of all stoppages. Three times this year the employees of the company have distinguished themselves by their successful efforts to save life. Two of these feats have been performed by members of the crew of the *Yarmouth Belle*, one of them by Mr. Mills, her chief officer. The third instance of an act of bravery was performed by W. Huntingford, of the *London Belle*, who rescued a lady who fell from Clacton Pier. This action was a very hazardous one, and it has evoked substantial recognition. The owners of the steamer have presented Mr. Huntingford with a silver watch, and the Royal Humane Society awarded him their bronze medal; whilst those who witnessed his gallantry made a handsome subscription on his behalf.

The New Cunarder.

The launch of the *Ivernia* for the Cunard Line from the yard of Messrs. C. S. Swan & Hunter is remarkable in many ways. First it shows that vessels of the class which great mail lines affect can be built elsewhere in Britain than on the Clyde and at Belfast. Secondly, it shows the type of development to which the oldest Atlantic company now turns; for a vast cargo, a few saloon and intermediate passengers, and a heavy steerage complement are what the new ship provides. The White Star idea is different altogether in regard to their intermediate ships. Having made a move towards the admission of passengers to their bigger cargo ships, Messrs. Ismay, Imrie & Co. carry none but first-class. The same curious distinction in policy is seen between the intermediate vessels of the great German lines. The Norddeutscher Lloyd *Barbarossa* and her sisters carry saloon only. The Hamburg-American *Pennsylvania* has accommodation for many steerage passengers as well as her first-class complement. The launch of the *Ivernia* gives Cunard's the biggest cargo ship afloat, she surpassing the *Cymric* in tonnage. It also brings the number of steamships of over 11,000 tons gross to 24. Of these the White Star Line have no less than seven—the *Oceanic* and *Cymric* on the Atlantic and the five sisters on the Australian line. The Hamburg-American Line also have seven. Their list is headed by the great *Deutschland* now building for the mail service, and includes the *Kaiser Friedrich*, which is perhaps more correctly described as being "under their flag." Two of this line's seven vessels were built at Messrs. Harland & Wolff's. The Norddeutscher Lloyd have two, both mail boats, and both constructed in German yards. The Cunard Line have four—the two mail steamers *Campania* and *Lucania*, this *Ivernia*, and a sister to her, the *Saxonia*, building at Clydebank, the discovery of whose frame possibly gave birth to the unfounded rumour of the new and vast Cunard mail boat. Then the Americans have two big ships in the *St. Louis* and the *St. Paul* and the Dominion Line two more in the *New England* and the *Commonwealth*. These two are Queen's Island ships, so that of the 24 in the list Messrs. Harland & Wolff are responsible for no less than 11; whilst three come from the Clyde, one from the Tyne, two from the States, and seven from Germany.

SIMPLE HEATING DEVICES.

It is an undoubted fact that our cousins across the water have a marvellous ability for the adaptation of known devices for new purposes, and in no branch of science is this more plainly shown than in the case of small tools. We have pleasure in describing and illustrating some of the heating devices of American manufacture which are being put upon the English market by the South British Trading Co., Limited, of 6, Victoria Avenue, Bishopsgate Street Without, London, E.C.

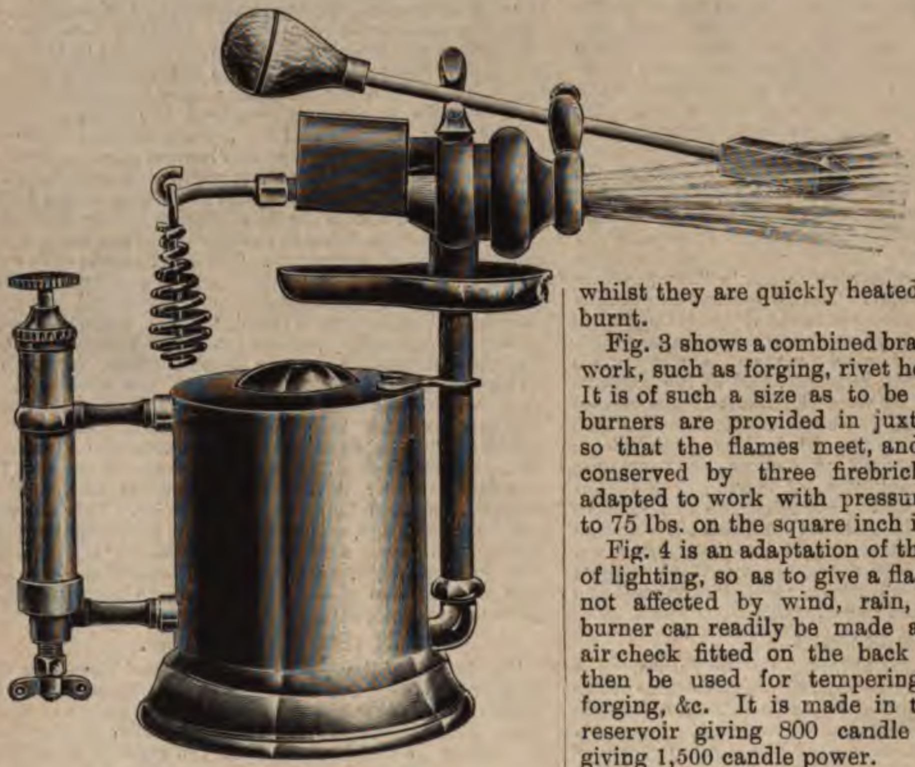


Fig. 1.

Fig. 1 represents a Kerosene Combination Hot-Blast hand-brazer, and is shown heating a soldering iron. It consists of a tank, or reservoir, with an air-pump attached to the side thereof, and adapted to pump air into the tank. The burner is supported on the tank by the feed-pipe for conveying the oil contained in the tank to the burner. A tray is provided under the burner to hold inflammable matter with which to heat the burner initially at starting. The quantity of oil consumed is regulated by the valve forming part of the burner. It will be noticed that a very simple, but, at the same time, effective, handle has been provided on this valve to prevent the transmission of heat from the burner to the hand. It consists of a spiral-wire formation, which is hooked to the valve-spindle by a central wire, so that the contact with the heated spindle is small and the surface for dissipating the heat very large.

Fig. 2 illustrates a modified construction of burner which gives special facility for heating tinmen's irons. The flames project from both sides of the generator through various apertures along a line 4 in. long, pass under the irons, strike the sides of the hood, and are deflected in a circle completely encompassing the irons, and, at the same time, keeping the generator hot for its work. The irons rest upon a corrugated support, which allows the flames to pass under them, and their points protrude beyond the flame, so that, whilst they are quickly heated, the tin on them is not burnt.

Fig. 3 shows a combined brazer and forge for heavier work, such as forging, rivet heating, and tool making. It is of such a size as to be readily portable. Two burners are provided in juxtaposition to each other, so that the flames meet, and the heat generated is conserved by three firebricks. This apparatus is adapted to work with pressures ranging from 35 lbs. to 75 lbs. on the square inch in the reservoir.

Fig. 4 is an adaptation of the burner for the purpose of lighting, so as to give a flame of clear white light, not affected by wind, rain, or temperature. This burner can readily be made a heater by moving the air check fitted on the back of the burner. It can then be used for tempering tools, heating rivets, forging, &c. It is made in two sizes, viz., 10-gallon reservoir giving 800 candle power, and 15-gallon giving 1,500 candle power.

The method of working is the same in each device, viz., the air is forced into the reservoir merely as a means for displacing the petroleum, which is led up by a pipe from the bottom of the reservoir into the vaporiser forming part of the burner, so that the oil issues from the latter in a gaseous condition, and being properly mixed with air at its delivery it burns with a smokeless flame. It will be seen that it is only necessary to pump air in to keep up the displacing pressure, which may be done intermittently, as the reduction in volume is so slow. The heating or lighting effect can be regulated either by the valve on the oil pipe or the pressure in the reservoir.

Samples of these heating devices can be seen at the above Co.'s Show Rooms.

H.M.S. "London" has been coated on the bottom with Hartmann's Rahtjen's Improved Composition (The Red Hand Brand) and which is annually supplied to over 1,100,000 tons of the British and Foreign Navies.

THE "OCEANIC."

ON January 14th of the present year the greatest and most elaborately fitted vessel ever constructed was put into the water at Queen's Island—a mere box of steel. Yet at the end of August of the same year she was on view in the docks at Liverpool, a ship instinct with life, beautiful in her appearance, filled with every luxury that modern ingenuity can devise for some 1,600 passengers of various classes (to say nothing of the great crew that is needed to work her), and ready to take her place in the reduction of the distance that separates the two portions of the Anglo-Saxon race.

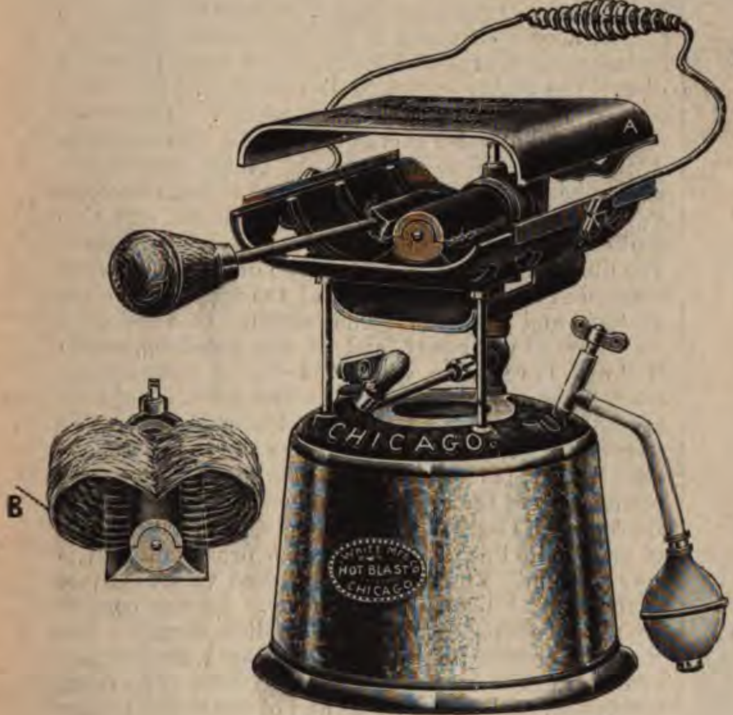


FIG. 2.

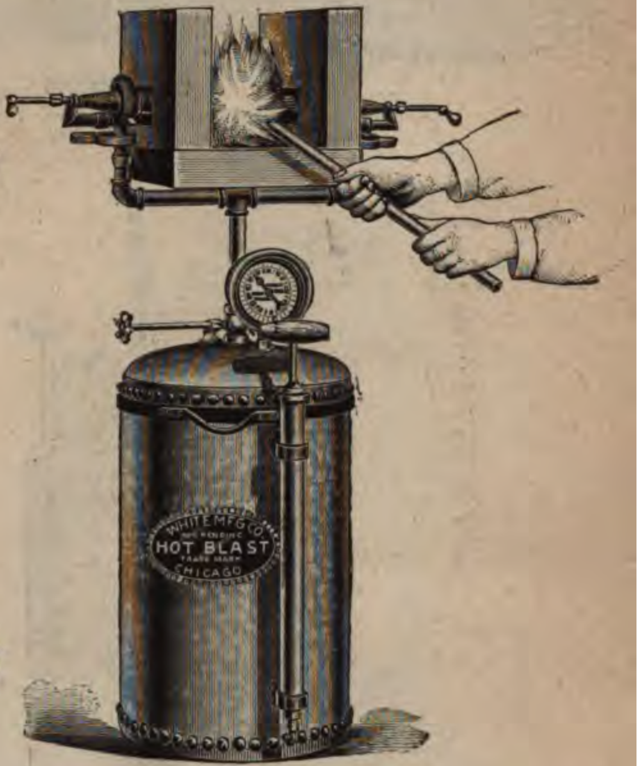


FIG. 3.

It is very difficult to describe such a work. The actual execution has taken the greatest firm of builders in the world over two years and a-half, to say nothing of the period consumed in drawing out designs. The highest art has been employed in decorating her. The ripest experience has been brought to study all the details for the comfort and the safety of those whom she carries. Yet, after a visit of a couple of hours, part of which time is necessarily consumed in social duties and in the requisite refreshment which a 400-mile journey entails, one has to glance at some of the points which so many experts have thought out.

The dimensions of the vessel are:—Length over all, 704 ft.; between perpendiculars, 685 ft. 7 in.; beam, 68 ft. 4 in.; and depth, 49 ft.

The gross tonnage is 17,274 tons; net, 6,176 tons, and displacement 28,000 tons at 28 ft. draught.

The construction of the ship has been all for strength. The main keel is 2 ft. wide. No less than nine longitudinal webs extend parallel with it for the greater part of her length, whilst throughout her length there is a double bottom 5 ft. 1 in. deep, except under the machinery space, where it is increased nearly 50 per cent. The frames of the vessel are spaced 31½ in. apart. They are of channel steel 9 in. deep, with 4 and 4½ in. flanges. The shell-plates are exceptionally long, to reduce weight as much as possible whilst increasing the homogeneity of the fabric. The general length of these plates is 28 ft., yet upwards of 17,000 are used, the general width being 4 ft. 6 in., with a minimum thickness of 1 in., and a weight ranging from 2 to 3¼ tons. The provisions for safety in case of accident are largely enhanced by the means of stiffening the hull. Thus there is a longitudinal bulkhead in the machinery space for a length of 97 ft., as well as 13 transverse bulkheads and no less than five steel decks. Upwards of 1,704,000 rivets have been used in the building of the ship, and the liberality with which they have been sown where strains may be encountered is particularly seen in the vessel's upper strakes amidships, where they appear to be almost continuous through the whole length of the plates.

Her bottom is coated with Hartmann's Rahtjen's improved composition—the Red Hand brand.

A remarkable forging is the stern-post, which, with the arms for carrying the screw-brackets, weighs no less than 98 tons.

The ship is, of course, rigged with pole-masts. These are three in number. She has two funnels, which, though they appear small enough when viewed as a part of the ship, would be huge enough tunnels laid on their side on *terra firma*. These have to take the waste products from the furnaces of no less than 12 double-ended and three single-ended boilers, which burn 550 tons of coal a day, and supply the steam at 210 lbs. pressure to the 28,000 H.P. engines which drive the ship. Fitted to the boilers are 98 Geddes "balanced" fire-doors and 98 Morison "suspension" furnaces, manufactured by Thomas Richardson & Sons, Limited, and the Leeds Forge Co., Limited, respectively. The main engines are two sets of triple with four cylinders in each. They are balanced on the Yarrow-Tweedie-Schlick principle, and the arrangements in the engine-room, combined with the staunchness of the hull, have managed (wonderful as it may sound) to get over the long-standing trouble of vibration when running at full speed at sea. The engine-governors are Aspinall's patent. The propellers are three-bladed.

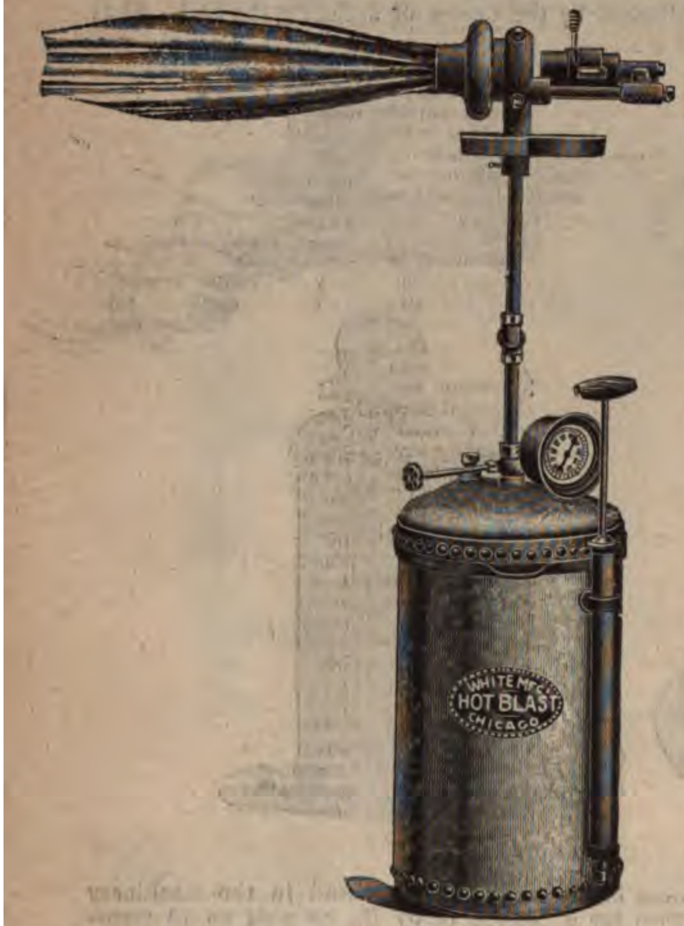


FIG. 4.

The chief feature of the ship is, however, her passenger accommodation. It may be remarked, as a sort of summary of the whole, that, though the gross tonnage of the *Majestic* and her sister the *Teutonic* is just under 10,000 tons each, and though the gross tonnage of the new ship is three quarters higher than this, the *Oceanic* does not offer to carry by any means a proportionately larger number of passengers. Thus, though shortness of room was never alleged against the old favourites, even greater space than they can afford is offered to each individual carried aboard the new ship. The saloon has as many seats as the ship has first-class berths, so every one can dine at the same time. The room is remarkable for its decoration. It is panelled in oak washed with gold, whilst its saloon dome, decorated with allegorical figures, representing Great Britain and the United States and Liverpool and New York, after the design of Mr. Norman Shaw, R.A., is very beautiful and striking. Its dimensions are: length 80 ft., breadth 64 ft. (being the full width of the ship), and height 19 ft. to the top of the dome. The usual interlocking tiles are furnished as a flooring throughout the passages and other usual parts of the ship, but in the main companion they are laid in a way not hitherto applied to steamers. Large lozenges of white rubber are at their corners cut into by small black blocks of the same shape. Thus the effect of a marble floor is conveyed to the eye, though the noiselessness and firmness of foothold are qualities of its own. The main companion is very fine. It is well lighted from above, and very roomy. There are striking and massive carved door-posts, coloured plain white, which lead to the passages at the side of the ship. The magnificent staircase has panels of brilliant Turkey red with gilt designs upon them, and this striking effect very much relieves the general view. The library is over the saloon, the dome of the lower apartment forming the centre of the room, as in the *Teutonic* and *Majestic*. The carving of the doors, which are of mahogany, and of the panelling, which is of oak, is very fine, whilst the electric light fittings are well worthy of notice. The design is that of two-candle wall sconces of the Empire character. The selection of books, both in this room and in the second-class library, is large, and the binding of both sets is reminiscent of the taste of the head of the firm. The smokeroom is lighted by two domes, one on each side of the middle line of the ship. Its ornamentation is very tasteful. The pictures represent various scenes in the life and history of Columbus. In the corners are niches containing beautiful Italian figures. The walls are covered with highly embossed leather gilt, and there is a carved mahogany frieze. The ornamentation, both of the frieze and of the stained glass sliding shutters to the side ports, is of sea-nymphs. The seating is very much after the style of that which is so greatly admired aboard the *Majestic* and *Teutonic*. The staterooms are large and lofty, whilst the rooms on the upper deck are most luxurious. The arrangements of these vary greatly. Some are panelled in silk cretonne, and there are most elaborate and convenient appliances for washing-stands and toilet tables. The beds in these rooms are *beds* and not bunks. Large tables, which are capable of being used by passengers either from the bed or from the seats, are fitted. Some of the rooms are arranged in suites, so that the wealthy Americans can have their bed, sitting, and bath-rooms all together. The general service of baths, lavatories, and sanitary conveniences is very perfect, and the ship is fitted with the usual barber's shop with its electrical appliances. The promenade deck is of course covered by a boat-deck after the modern fashion. The clear space upon it is very striking, though only natural in view of the ship's great beam; its length is about 400 ft. For convenience of those who spend their days here there is a cloak-room for wraps in the deckhouse, and the deck-steward has his pantry and his lift. Above this deck on the navigation deck are ranged the 24 boats in long rows, and here are the chartroom, the wheelhouse, the captain's house, and the officers' quarters. Thus those who are entrusted with the responsibility of directing the fortunes of the great vessel are quite isolated from the distractions of the crowd. There is a stairway, too, to this deck from the engine-room, so that, without passing through the public quarters, Captain Cameron and Mr. Sewell, (the commodores of the navigation and engineering departments of the line respectively), can hold their conferences. The steering gear is in an after-house. It is of the usual type which the builders put into their vessels, though, of course, of extra strong and massive construction. The usual springs for relieving the strains when the rudder is struck by a heavy sea are provided, as well as full appliances for alternative handling of the ship in case of a breakdown.

The second-class passengers have their accommodation aft of the first class. Their public rooms are very luxurious and comfortable, and their staterooms seem little inferior to those of the first class. The steerage arrangements as regards the separation of the sexes are on the usual White Star principle. Closed rooms are provided here for both the married couples and for the single women.

The first voyage of the *Oceanic* was characteristic of the thoroughness with which her owners prepare against every eventuality. An abortive strike was in progress in Liverpool, and the strikers—regardless of the benefits which the line has conferred on their class—thought that stopping the new vessel for want of firemen would be a weighty stroke. So, as a precautionary measure, the *Oceanic* did not come alongside the stage. She weighed anchor and dropped down to the bar just before dusk on the evening of Wednesday, September 6th. She was at Queenstown between eight and nine o'clock next morning. That port she left at 12.40 p.m. on the 7th, having then on board 383 saloon passengers, 244 intermediates, and 829 in the steerage. Her crew numbered 434 persons, so that altogether she carried 1,790 souls. The Right Hon. W. J. Pirrie, managing director of the firm which designed and built her, was amongst the passengers. It was unfortunate, indeed, that serious illness prevented Mr. Ismay from being there also. The vessel encountered a swell on the first day out, and on the following day a moderate sea from the south-west; on the third day there were showers, and on the fourth a little haze, but generally the weather was all that could be desired. She sighted Fire Island at 8 a.m. on the Wednesday after sailing, and was abreast of the lightship at Sandy Hook at 10.17 a.m. Her passage was thus 6 days 2 hours and 27 minutes, and her speed 19·57 knots. She never developed above 20,000 of the 28,000 H.P. of which she is capable, and never rolled more than five degrees. This may have been thank partly to the bilge keel with which she is fitted, but the design and size of the ship must have largely contributed to this result. All went perfectly smoothly, and her engines were never even slowed. Mr. Sewell, the chief engineer of the ship, as well as the makers of the engines, must be congratulated on this performance. The daily runs were: to noon on September 8th, 443 miles; to noon on the 9th, 470 miles; to noon on the 10th, 457 miles; to noon on the 11th, 496 miles; to noon on the 12th, 483 miles; and to Sandy Hook, 431 miles. Thus the total distance covered was 2,780 nautical miles. She was alongside her dock at 1.45 p.m., great enthusiasm marking her reception. She left on her return trip at 6 p.m. on September 20th.

THE "PETTER" PETROLEUM ENGINE.

THE use of petroleum as a motive fluid appears to be receiving the attention amongst engine manufacturers that its ready application and general convenience entitle it to. It is particularly suitable for small powers where a minimum of space is only available.

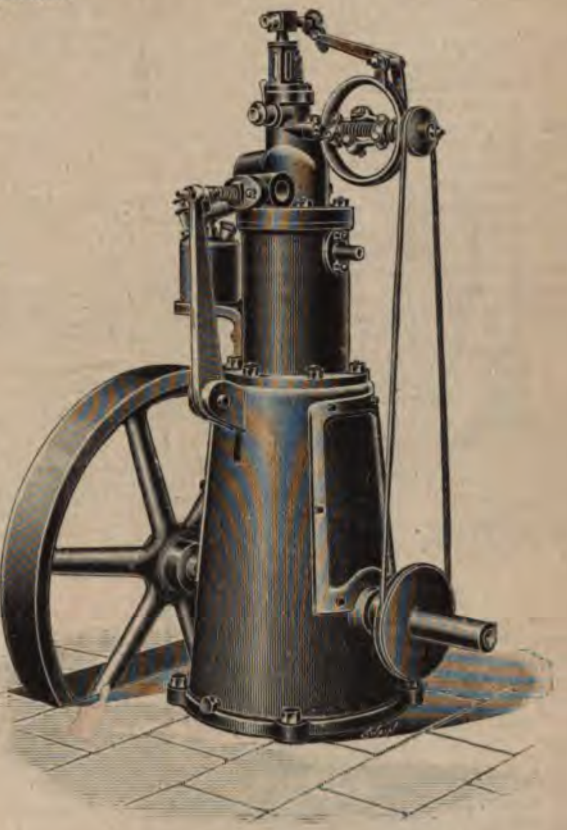


Fig. 1.

We illustrate in the adjoining diagram one of the 1¼ brake H.P. vertical petroleum engines built by Messrs. James B. Petter & Sons, of the Nautilus Works, Yeovil, Somerset, for use in river launches, and the essential feature which is prominent in the design is simplicity of construction, especially with regard to the arrangement of the valves. It will be observed that there are only two valves, which are placed opposite to each other in such a manner that both valves can be removed, inspected, and replaced by removing only one of the valve-boxes, and thus

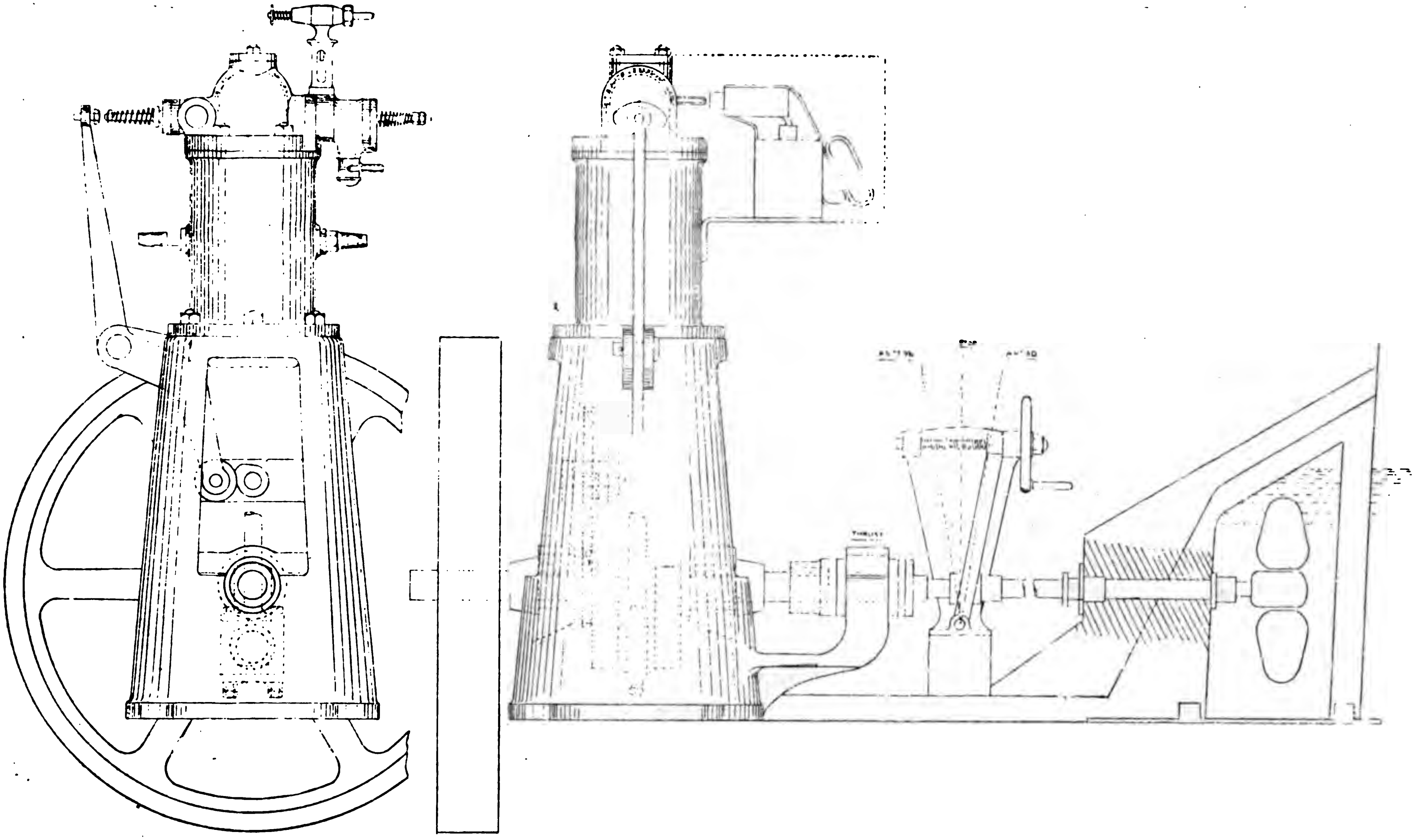


Fig. 2.

breaking only one joint. The oil and air inlet-valves are operated by the suction of the piston, whilst the exhaust-valve is worked by a lever actuated by gear-wheels driving by the main shaft.

Fig. 1 shows a perspective elevation of the engine complete, and Fig. 2 is a vertical longitudinal elevation showing the engine installed in a boat and connected to a propeller, which is feathering and fitted with blade-controlling gear. The engine is governed by a centrifugal governor, which controls the oil supply. The bed of the engine is adapted to contain the crank-shaft and all gearing, so as to entirely enclose the same, thus keeping it free from dust, preventing splashing, and reducing the noise of the working parts. As seen in the diagrams, doors are provided for obtaining access to the working parts.

The vaporiser which forms the top or back of the cylinder is heated by means of an atmospheric lamp in the usual way, the explosion of the vapour being effected by tube ignition.

The space occupied is very small, and the general arrangement and construction is such as to ensure the engine running for a long period without attention.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

A New Armour Plate.

AMONGST the experiments which have recently been conducted at Shoeburyness was a most interesting one with a new kind of armour plate. This plate is made up of six inches of ordinary steel, and faced with three inches of a special composition, the nature of which is being kept a secret. A 350-lb. projectile was fired at the plate from a distance of 200 yards, black powder being used, but on investigation it was discovered that the plate was practically uninjured. The same proved to be the case after several rounds had been fired, and in some cases we are told the projectile was reduced to dust by the force of the impact. When cordite was used, however, the plate was penetrated about three inches, and in some cases pierced, but in no instance did the plate crack, a circumstance that leads one to believe that the new armour plate would be useful in naval warfare. A hole caused by a projectile going through a plate can always be plugged with matting, but it is far more difficult to stop the inrush of water if the plate is cracked and smashed. As a result of two shots being fired at the plate simultaneously, and hitting it within a space of 18 in., the special composition was still unfractured. When fired at obliquely, however, the special facing split from the steel backing, a result which was somewhat unexpected, for before this course was adopted the welding of the ordinary steel plate and the special composition could not be detected.

The Russian Navy.

Russian shipbuilding yards are at present as busy as ever hurrying forward the various battleships and cruisers in course of construction. On the Neva great activity is being displayed, and at the Galerny Island yard a large battleship of 13,600 tons has been laid down. The *Pallada*, which it will be remembered was launched a short while back, and her sister cruisers are all being rapidly pushed forward. The new battleship laid down is presumably an enlarged *Tsarvitch*, for the displacement is said to be greater than has yet been reached in Russia, the ships of the *Sevastopol* class being of less than 11,000 tons, and the new ships still in hand of about 12,600 tons. The sister ships of the *Pallada*, the *Diana* and *Aurora*, are still in hand. They are of 6,630 tons displacement, fitted with Belleville boilers, from which it is calculated to give them an I.H.P. of 11,610. An interesting anecdote is related in connection with the *Pallada's* namesake, a frigate sunk in 1856 in the Imperator Nikolai Harbour to prevent her falling into our hands. She lies in about seven fathoms of water, and recently Lieutenant Apastasiev went down in a diving bell and brought away an iron bolt, out of which Captain Beltin, one of the six survivors of the ship's company, had a beautifully ornamented inkstand made, with a silver plate affixed bearing the names of the frigate's company engraved upon it. He has presented the inkstand to the captain of the new cruiser for the use of himself and of his successors.

Portsmouth Dockyard.

The departure of the *Terrible* for the China Station relieves this yard of a deal of trouble. Whether she would get through the Suez Canal without running aground was discussed by many here, and the same doubt was felt as to the ability of the *Powerful* to come home *via* the Suez Canal without running into danger. It was supposed that the two ships would meet at Port Said about the 1st of this month, but there is more likelihood of their meeting in the vicinity of Simon's Bay. Both the *Powerful* and *Terrible* would have had to have their weights adjusted so as to give them as trim and even a keel as possible. Some disappointment was felt when it was finally settled that the Lady Mayoress of London was not to officiate at the launch of the *London*. The honours were to be instead carried out by Lady George Hamilton, whose presence was doubly welcome, as it is so many years since she has officiated at a function of this kind. There were, however, a good many who had hoped that the Lady Mayoress would have presided. Work is to be commenced on the new battleship *Kent* now that the *London* has taken the water.. A good deal of material has already been prepared, and the work of lengthening the building slip by more than 100 ft. is almost completed. As regards the other vessel under construction here, the *Pandora*, it is doubtful when she will take the water. She has now been under construction for nearly three years. However, a time will come. Experiments are still in progress with the *Surly*, and at present briquettes are being used, and although they are not quite as smoky as oil, they are not what may be termed a distinct success. The *Canopus*, as was expected, has proved that she is not so much the failure she was asserted to be by one of the London dailies. It has been proved now that she can steam at 17 knots continuously for 10 days with her normal coal supply, thus being able to cover a distance of more than 10,000 miles without resorting to a coaling station. The first-class cruiser *Scout* will not be out of hand until the 31st of this month instead of the 1st.

The United States Navy.

The builder's trial of the new United States battleship, *Alabama*, is said to have been satisfactory in every particular. The speed attained was $17\frac{1}{4}$ knots, whereas the contract required a speed of but 16 knots. On the first run the *Alabama*, under $103\frac{1}{2}$ revolutions, averaged 15·25 knots an hour, over a course of $11\frac{1}{4}$ knots. She steamed over the course twice in a moderate sea, half of the way against the wind. On the second run, under forced draught and at $114\frac{1}{2}$ revolutions, the average speed was 16·33 knots, and on this run the maximum of $17\frac{1}{4}$ knots was attained. In the annual report of, Chief Naval Constructor Hitchborne it is stated that the sum of 16,000 dols. was expended in preparing the *Oregon* for her trip to Manilla, and 25,000 dols. in getting the *Iowa* ready for her voyage to the same place. Mention of Manilla reminds one that great preparations are being made for the return of Admiral Dewey. However, the gallant admiral will probably do his best to escape as many as possible of the entertainments and dinners which are sure to be given in his honour. Following the example of Admiral Dewey, Admiral Sampson has laid a claim in the Supreme Court of the District of Columbia for prize money to the amount of 700,000 dols., which he claims is due to himself and the officers and men under him who took part in the battle of Santiago. The greater portion of the money claimed is for the capture of the *Infanta Maria Teresa*, which, after being refloated, disappeared beneath the waves off Cat Island. Experiments are about to be carried out in the United States Navy with metallic furniture. A suite of furniture made of cold-rolled steel with bronze ornamentation is to be supplied to the *Atalanta*, and the officers of this ship are to report upon its suitability to the Navy Department.

Stranded Warships.

From news to hand from Hong Kong it appears that the repairs to the *Bonaventure*, made necessary by the damage sustained when she went ashore in Kernileff Bay, will cost from £6,000 to £10,000. During the salvage operations the *Undaunted* also sustained some damage, having the casing of her after hawse-pipes torn out, and many minor fittings in the shape of cleats, cowls, stanchions, davits, &c., carried away. A correspondent, writing from Hong Kong, says that when the *Bonaventure* struck, the force of the impact raised her bows almost clear of the water, and there she remained. The *Undaunted* at once went to her assistance, and endeavoured to tow her off the rocks; but after several cables had broken, several minor accidents happening in consequence, the attempt was abandoned until other ships could render assistance. Despite the efforts made on the following day, it was not until the forenoon of the third day that she had been stranded that the *Bonaventure* was floated. When she finally was released she was temporarily patched up and sent under her own steam to Nagasaki. At a court-martial held subsequently on Captain Montgomerie and the navigating officer of the *Bonaventure* both these officers were honourably acquitted, the court holding that the rock was unknown, and that they had done everything in due order. The court-martial held on Lieutenant and Commander J. W. Pochin and Lieutenant H. F. Dawson at Simon's Town in connection with the stranding of the *Thrush* resulted in both officers being reprimanded. The vessel was ashore five and a-half hours in all. In the opinion of the court, insufficient allowance was made for the currents in shaping the vessel's course past Cape Delgado, and no leadsman was posted in the chains at the time of the occurrence. It was admitted, however, by the judges that every effort was made to refloat the vessel in the shortest time.

The Navy and South Africa.

In connection with the dispute between the home Government and the Boers in the Transvaal Republic, it was suggested that a naval brigade should take part in any fighting. Such a course would be only fair considering that the Navy has taken part in so many of our "little wars" in South Africa, and especially in the fighting between the Transvaal Republic and this country. There was a naval brigade at Majuba Hill under the command of Commander Francis Romilly, and unfortunately this gallant officer was killed in that disastrous fight by a wound in the abdomen. Fleet Surgeon (then Surgeon) Mahon attended him until the last, and also gave others wounded in the rout the benefit of his skill, which led to his being taken prisoner by the Boers. A bullet penetrated his helmet whilst engaged in this humane work, and he richly deserved, but did not get, the Victoria Cross for his gallant conduct. Lieutenant Trower, a gunnery officer of the *Boadicea*, was another naval officer killed at Majuba Hill, and therefore the Navy has every right to take part in avenging the defeat and the conduct of the Boers towards the vanquished and their medical attendants afterwards. Disappointment will certainly be felt if the Admiralty do not sanction the landing of a naval brigade in case of hostilities. It would not, perhaps, be wise to deplete the Cape Squadron to too great an extent, but a few hundred seamen and marines with guns could be landed and be scarcely missed. A naval brigade would probably render as good an account of themselves nowadays in Africa as they did against the Zulus when Cetewayo threatened Natal.

Devonport Dockyard.

The most important event for the present month at this yard will be the launch of the *Bulwark* on the 20th. The *Bulwark* will by this time have been only seven months under construction, reckoning from the date when she was "officially commenced." There are many new vessels completing here, for, in addition to the *Ocean* and *Implacable*, there are the *Hermes* and *Highflyer*, cruisers, the *Thistle*, gunboat, and *Leven*, torpedo-boat destroyer. The *Ocean* will probably be quite as much a success as the *Canopus* has proved herself to be. The trials of her auxiliary engines and the port engine of the propelling machinery were both very satisfactory. The engines and boilers for the *Implacable* have now arrived at this yard, and Messrs. Laird Brothers are to establish here a local staff of about 50 mechanics and labourers to work on the machinery of the vessel. Preparations are being made for the establishment of another Whale Island at Devonport, and negotiations are in progress for the purchase of 150 acres of ground on the Cornish side of the Hameaze. However, it will be many years before the buildings ashore are ready to take the place of the existing gunnery-ship. The new Royal Naval Barracks continue to make rapid progress, but it will be some two years before they are completed. The Admiralty have decided to increase the number of warrant officer artificer engineers from 46 to 75, and there are a large number of candidates for the posts. The steam trials of the new twin screw-gunboat *Thistle* were successful in every way. She is to be commissioned next month for the West Coast of Africa. The *Hermes* is to be commissioned on the 5th inst. for service on the North American and West Indies Station.

An Imperial Programme of Work.

The programme of work mentioned in the Naval Works Bill is very heavy, and before the various items are finished many millions of money will have to be spent. That the college, barracks, harbours, and defensive works referred to by Mr. Goschen are badly needed there is no doubt whatever, and therefore the First Lord was not doing anything very rash when he challenged anyone to point to a single undertaking which was not absolutely necessary. The proposed outlay is very large, but the country will have ample value for its money in the many important works to be carried out. The breakwater extension at Portland Harbour is now practically completed, and the work on the detached and commercial moles at Gibraltar continues to make good progress. The necessity for these moles is clear to all, for, when finished, an effective torpedo attack on the shipping at "Gib." will be practically impossible. There is, by the way, an excellent article in a recent number of the *Navy and Army Illustrated* on the works at the Rock, accompanied by photographs. New dockyards, docks, and railway connections are to be commenced at Dover, and the extension of the Keyham workships completed as early as possible. The new Royal Naval College at Dartmouth is also to be commenced without delay, and at Hong Kong there is to be an extension of the present defensive works. On improved dock accommodation for our warships some £6,000,000 are to be spent. Chatham is to have a new dock capable of accommodating the largest battleship afloat, and at Malta two new docks are to be built, one of 790 ft. and one of 550 ft. Bermuda is to have a first-class floating dock, 13 acres in extent, and new docks are to be commenced at Simon's Bay for coaling purposes, and also at Hong Kong. These are only some of the chief items in this truly imperial programme.

Some Details of the "Holland" Submarine Boat.

Some interesting details are to hand from America about the *Holland* submarine boat. Its owner claims that it can move about under water after the manner of a whale, and whilst in this position can discharge its dynamite guns with deadly effect. The boat contains three pieces of ordnance, two of which are invented by Mr. Holland himself. In the bow of the boat is a torpedo tube for the regulation Whitehead torpedo used in the Navy. Above and directly in line with the Whitehead tube, but pointing up at a higher angle, is the dynamite gun. In the stern of the boat is a tube designed to discharge a submarine projectile with great force at the hull of a warship. Inside she is a "marvel of mechanical ingenuity," every inch of available space being taken up by some piece of intricate mechanism. The hull is built in the strongest possible manner. It is made of plates of half-inch milled steel, bolted on over frames in longitudinal sections, and is braced to resist the crushing power of water. When awash the displacement is 65 tons: the addition of ten tons of water in the compartments sinks the boat 50 ft., and she cannot go below that depth. The *Holland* has a cruising radius of 2,000 miles. She could take aboard 40 gallons of oil and (which is very doubtful) go two-thirds of the distance across the Atlantic. Fitted with sleeping accommodation and cooking apparatus on a small scale, the boat could go on an independent cruise for two months (another doubtful statement). The *Holland* is steered by four rudders, two in each plane, all controlled by electricity. To submerge the boat, the storage batteries are first charged from the dynamo, and the fumes of sulphuric acid exhausted. The cap of the hood is screwed down from the inside, and word is passed from the executive officer to the gauger to flood the water-bottom. If the boat is to sink very far, the gauger puts the index of the submerging dial to a high figure, and having set the pointer to the desired depth, the controlling valves admit exactly that quantity of water and no more. To come to the surface, the water is blown out of the compartments by the stored air, or it is pumped out by electricity. The *Holland* boat has recently undergone some tests in discharging torpedoes and running under water, as well as partly submerged, and these tests are said to have been successful.

Sheerness Dockyard.

There are completing at this yard the *Perseus* and *Prometheus*, cruisers, and the sloops *Condor* and *Rosario*. As regards the *Perseus*, she is rapidly advancing towards the stage of completion. If her trials are as successful as those of her sister ship, the *Pioneer*, this yard may congratulate itself on the work done by those employed here on her. The *Pioneer* completed the whole of her trials in six days, commencing with a preliminary steam trial, and going through the whole gamut up to her circle-turning trials. Early last month the *Skipjack* arrived from Jarrow-on-Tyne. She has been fitted with the Reed type of water-tube boiler at Messrs. Palmer's shipbuilding yard. Her official trials will take place before long, but she has yet to undergo an extensive overhaul of her hull. Her present refit will cost about £39,000, of which nearly £33,000 has been expended on her new machinery and boilers. The gunboat *Speedy* has had her boilers retubed with Messrs. Thornycroft's type of boiler, and at her trial a speed of 19½ knots per hour was attained. She is to be completed for commission without delay, and will probably hoist the pennant at the end of this month. The refit of the *Ganges*, until lately the training ship at

Falmouth, is to be completed at this yard instead of at Devonport. She is to recommence her instructional duties at Harwich when completed.

A Pamphlet for Naval Engineers.

A reminder of the recent agitation amongst naval engineers—an agitation which had practically no satisfactory results—is given us by the publication of a pamphlet printed at Plymouth dealing with shorthandedness and other grievances of the engineer officers of the Royal Navy. The pamphlet deals with the engineer officer, both at school and on board ship, and suggests several improvements which might be made in the position of the students at Keyham, and one which certainly deserves mention is that prizes in reduction of fees be awarded and the number of students be increased with a view of extending the list. The writer of the pamphlet, "An Engineer (not R.N.)," gives some particulars of what it costs to train a youth for the various branches of the service. Not including uniform as commissioned officer, the writer has come to the conclusion that to train a youth for the engineering branch of the Navy would cost £576; for the medical branch, £606; for the executive branch, £593 10s. (from which £100 is deducted for the year's schooling, during which other branches are receiving pay); and accountant branch, £182 (from which £118 12s. is deducted for pay received from 18 to 20). Of course, under certain conditions these figures will alter very considerably. In another part of the pamphlet the writer deals with the question which arose some months ago as to the smallness of the number of engineers in command of the machinery of warships, and also the question of giving engineers the privilege of reprimanding and punishing the men under them as occasion demands. It will, without doubt, be some time before the anomalies in the engineer's position pointed out by "An Engineer" are removed, but the pamphlet clearly and without prejudice sets forth the case of the naval engineers, and therefore is worthy of attention.

Coaling Vessels at Sea.

An ingenious device for coaling vessels at sea has just been brought forward by the Lidgerwood Manufacturing Co., of New York. This firm is well-known as the makers of hoisting engines and cableways, and therefore it is only natural that they should have turned their attention to the subject of adapting some special form of cableway for the purpose of coaling vessels at sea. Their efforts appear to have met with considerable success, for the Navy Department of the United States are said to have shown great interest in the invention, and have accordingly entered into an agreement with the company to equip one of the steam colliers belonging to the department with one of these sea-coaling cableways. This vessel has been ordered to the New York navy yard, and the Lidgerwood Manufacturing Co. are immediately on her arrival to set to work to instal their apparatus. In this device the warship may take the collier in tow, or the collier may take the warship in tow, leaving a space between the ships of 300 ft. Elevated cables, leading from the masthead of a collier to shear-poles on the warships, serve to support and propel a carriage, from which hang bags of coal. The coal is elevated from the deck of the collier, transferred to the carriage at the masthead, and propelled across the intervening space at a speed of 1,000 ft. per minute. The arrangement for compensating for the lurching of the vessels in seaway, it is said, is exceedingly ingenious, and having been tested on a small scale, leaves little doubt as to the working of the appliance at sea. Coaling can be carried on whilst the ships are moving ahead. The idea is good, and therefore it is to be hoped that the invention will prove to be of practical value.

Chatham Dockyard.

It was originally intended to have launched the *Venerable* in August last if a satisfactory stage in her building had been reached by that time. Unfortunately, however, it will be some little time before she takes the water. As a number of distinguished guests are to be present at the ceremony, and Admiral Holland's house is not at present in a suitable state for entertaining, this will delay her taking the water as early as she could have done. Her predecessor, the *Irresistible*, was built in eight months, and, as Princess Christian performed the christening ceremony for her, the Princess Victoria has been approached with the object of inducing her to officiate at the launch of the *Venerable*. As soon as the *Venerable* takes the water, a new battleship, at present unnamed, will be commenced on No. 7 slip. She is to cost considerably more than £1,000,000, and is designed upon similar lines to the *Canopus*, but is expected to be more powerful and speedy than any ship of this class. There are four first-class battleships now in hand at this yard, reckoning the new battleship, as the *Venerable*, *Goliath*, and *Irresistible* are all in an incomplete state. Preparations are also being made for the construction of a new third-class cruiser. The official report of the trials of the water-tube boilers and machinery of the *Pioneer* states that they passed off without the slightest hitch throughout. Some little doubt was felt at first whether this would be the case. At her eight-hours natural draught trial the average speed was slightly below what it should have been, but the mean H.P. was in excess of that stipulated. She will probably hoist the pennant at the end of this month and proceed to the South-East Coast of America to relieve the *Beagle*. Rear-Admiral Andoe's place as superintendent at this yard has now been taken over by his successor, Rear-Admiral S. C. Holland, who hoisted his flag on board the *Pembroke* at the commencement of last month.

Coal Consumption of the "Canopus" and "Ocean."

A considerable amount of hostile criticism has been expressed as to the excessive coal consumption of the new first-class battleships *Canopus* and *Ocean*. The evidence, however, hardly warrants this, for although it is a fact that the contract trials were not quite as successful as could be wished for, it is probable that the coal consumption will be considerably diminished when the proposed alterations in draught have been effected. The Belleville boilers must not be blamed for the trouble, although many critics, attaching too much faith to the utterances of the member for Gateshead, have endeavoured to make us believe that this is the case. One London daily paper, which is nearly always ready to air the views of either officers or men of the Navy who consider they have "grievances," asserts that both ships are failures. The "naval expert" of the *Morning Post* would do well to make a deeper study of the engines and boilers of warships than he evidently has done before coming to such a rash conclusion. The *Canopus* and *Ocean* are admittedly experiments as far as their boilers are concerned, and therefore criticism of this nature should be deferred until the experiments have had a fair chance. Probably nobody at the Admiralty wishes more to see our warships possessing high speed, powerful armament, adequate protection, and large coal capacity than Sir William White, and to obtain these necessary qualifications experiments are bound to be carried out. There is little doubt that in time the *Ocean* and *Canopus* will prove good and economical steamers, and will be as great a success as the giant cruiser *Powerful*.

Elswck-built Crusers.

The paper read by Mr. Watts, the chief constructor of Elswick shipyard, has brought about some arguments in the weekly press which are worth referring to. The chief argument brought forward by the adversaries of the type of cruisers constructed at Elswick is that Mr. Watts did not give details as to weights or publish working drawings of the vessels and specifications. No doubt Mr. Watts refrained from giving this information with good reason, but if he could have done so, and, at the same time, have compared them with the weights of the cruisers built in the Government dockyards, more point would have been given to Sir Edmund Fremantle's remarks about the Admiralty authorities being horrified at the idea of taking anything out of a ship, and that, in consequence, weight which might be better employed was taken up by obsolete equipment. In a letter to the *Army and Navy Gazette* explaining some parts of the speech with which he opened the discussion at Newcastle, Sir Edmund Fremantle said that he merely wished to show that the natural conservatism of a great service such as the British Navy made us reluctant to move with the times and to sacrifice weights, whether in structure, armament, or stores, which had previously been considered essential. He also considers that we have shown little reluctance of late years in adopting new inventions and improvements; but that we cling too much to the idea of making a modern battleship or cruiser as self-contained as possible with qualities of strength and permanence, which are no longer necessary or advisable, in view of our numerous depots abroad, where our ships must go for coal, and the fact that the types of ships of war are constantly changing. He gives a few comparisons between the vessels built for the Japanese Government and the British cruisers of the same type in order to prove his point; but he has apparently forgotten to mention that the Japanese cruisers are built for service principally in Japanese waters, and that they could not probably bear the strain of racing from one end of the world to the other, as British cruisers do, without developing some serious defects. Admiral Fremantle must know that there are strong reasons for making British battleships or cruisers "as self-contained as possible."

Pembroke Dockyard.

The new Royal yacht will probably be undocked on the 15th of next month, when she will depart for Portsmouth, where she will be completed about the 18th. Rear-Admiral Sir John Fullerton visited this yard last month, and gave instructions regarding some proposed alterations, which necessitated the transference to her of two additional gangs of shipwrights from the *Spartiate* and *Drake*. One of these proposed alterations concerns the ornamental work on the stern. The non-inflammable wood fittings are even now said not to be quite as satisfactory as could be wished, even after the chemically treated timber had been treated with charcoal. The feed pumps of the boilers in the new yacht were found to have too large a bore, and consequently were returned to the makers to be altered. The covers and the tubes in the boilers will be made to a universal pattern. There is a considerable difficulty in this, for the boilers will contain about 5,000 such covers, and an additional 1,000 spare covers are to be provided. The *Drake* is probably one of the most interesting cruisers at present under construction in any of the yards. She and her three sisters and the four ships of the *Essex* class are all to have their armour extended to the bows, and also from the lower protective to the upper deck. In the opinion of some naval architects the fitting of armour so far forward has many difficulties, due to the extra weight. Preparations are being made to receive the keel of the *Essex* in No. 5 building slip. Captain C. J. Barlow has taken the place of Captain Burgess Watson as superintendent at this yard, on the cutter's promotion to flag rank.

Charity for the Navy.

Admiral Sir N. Bowden Smith, the Commander-in-Chief at the Nore, has just made an appeal through the medium of the press for subscriptions towards building a sailors' home at Chatham, where a suitable site has been obtained from the Government for that purpose. Admiral Smith points out that Chatham is far behind Portsmouth and Devonport as regards recreation and wholesome accommodation for the men, and that, although there are on occasions from 6,000 to 10,000 men quartered there, the only place in the town for their use is the "Sailors' Welcome," a small home conducted on temperance principles. This home is now quite inadequate for the requirements of the place; and it appears that many men are driven to look for beds in slums and other wretched places, since sufficient respectable accommodation for them is not to be found. It seems a little out of place that the Navy should have to appeal to public charity in order to get suitable accommodation for our naval seamen; but it must be remembered that the required accommodation is principally for men on leave, and who are, therefore, to a certain extent not under the control of the Admiralty. However, it is to be hoped that the British public will respond as generously as possible to Admiral Bowden Smith's appeal. It is proposed to conduct the new venture on the same lines as the Home at Portsmouth, controlled by Miss Agnes Weston. The estimated cost of the building is £15,000, and donations toward the proposed home may be sent to the Capital and Counties Bank, High Street, Chatham; or to Captain G. L. Atkinson, Dockyard Reserve House, Chatham; or to Admiral N. Bowden Smith, at the Admiralty House, Sheerness.

EXPANSION GLAND FOR STEAM-PIPES.

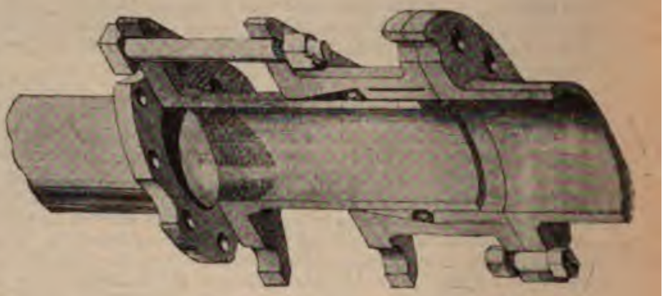
THE many serious accidents to steam-piping on board ship have pointed out that every precaution should be taken by steamship owners and by the Admiralty that such pipes should be protected by any device that may tend to give them elastic movement under strain or vibration and power of expansion and contraction under changes of temperature.

Mere elasticity of design of ranges does not seem to have done much in this way, nor is a single deep expansion gland, usually filled with dense packing, of much service, as such a gland is absolutely rigid, except as regards longitudinal movement, and the excessive friction of the usual long hard packing is well known.

The device we illustrate herewith seems to us much more effective than anything we have seen as yet, both as an expansion gland for changes of length due to changes of temperature and also as adapted to permit a considerable amount of elastic play in all directions.

This is effected by there being no length of hard packing employed, and by the end of the pipe being a free fit within the gland.

The pipe terminates within a gland, the bore of which is conical, terminating with its smallest diameter at its exterior, and within which are one or more packing-rings. The packing-ring is made from the best asbestos cloth, and on entering behind the ring it is forced up between the pipe end and the conical gland, making a steamtight joint by the pressure of the steam itself.



The outer end of the gland being a free fit on the pipe, and the inner end of the latter being also free in the bottom of the gland, the pipe can rock to some extent upon the packing-ring; and the frictional grip is very small, and thus permits easy play of one part of the pipe to the other, both laterally in any direction and longitudinally.

This is as nearly as possible a universal joint with an end movement also, which is exactly the desideratum for the perfect relief of a line of piping under vibration, shock, strain, or expansion and contraction.

In order to fit a new ring of packing, the joint between the gland and the junction piece is broken, the neck bush (which is in two segments) is removed, and the ring of fresh packing is passed over the pipe end.

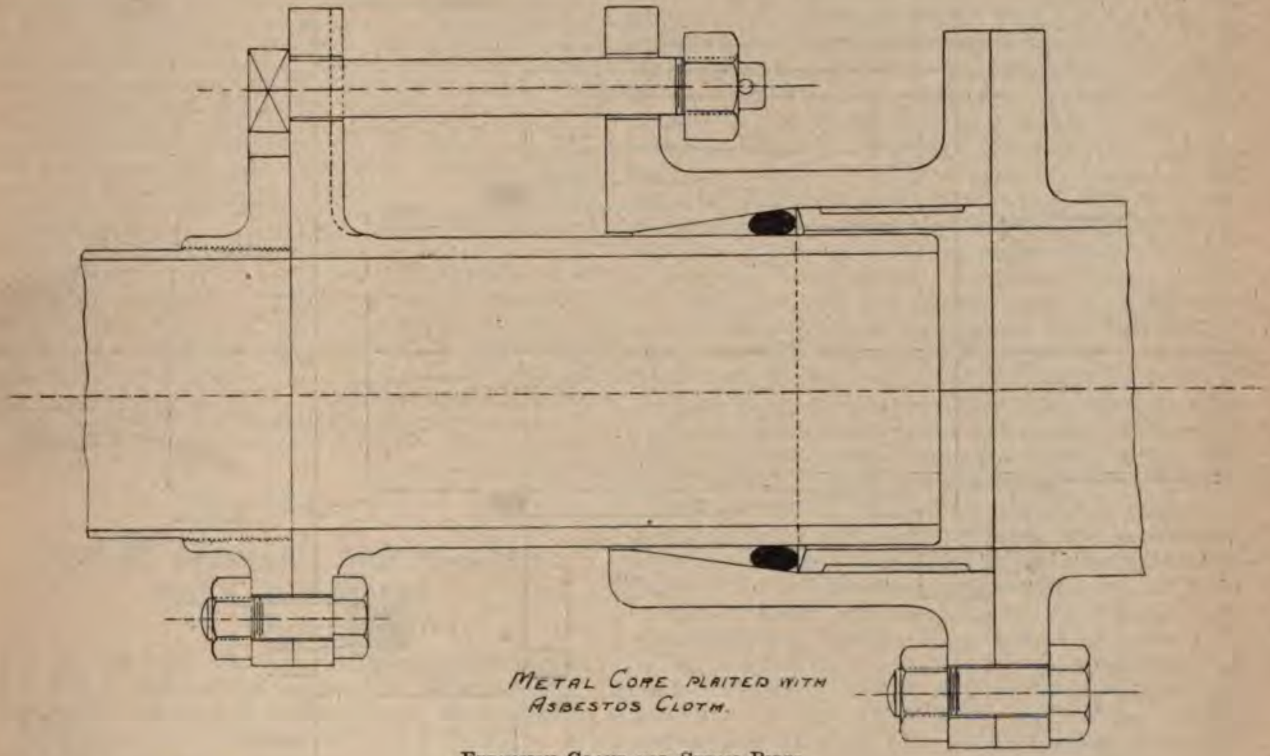
Nothing could be simpler than this joint, require less attention, or have less tendency to become hard and obstructive, as would be the case with a long ordinary packing under high pressure.

We understand from the makers (Messrs. Thomas Richardson & Sons, of Hartlepool, and the introducer, Mr. Geddes, of Liverpool) that these glands are working most successfully at sea with boiler-pressures up to 220 lbs., with only one ring of packing. There can be no doubt, therefore, that they are steamtight.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

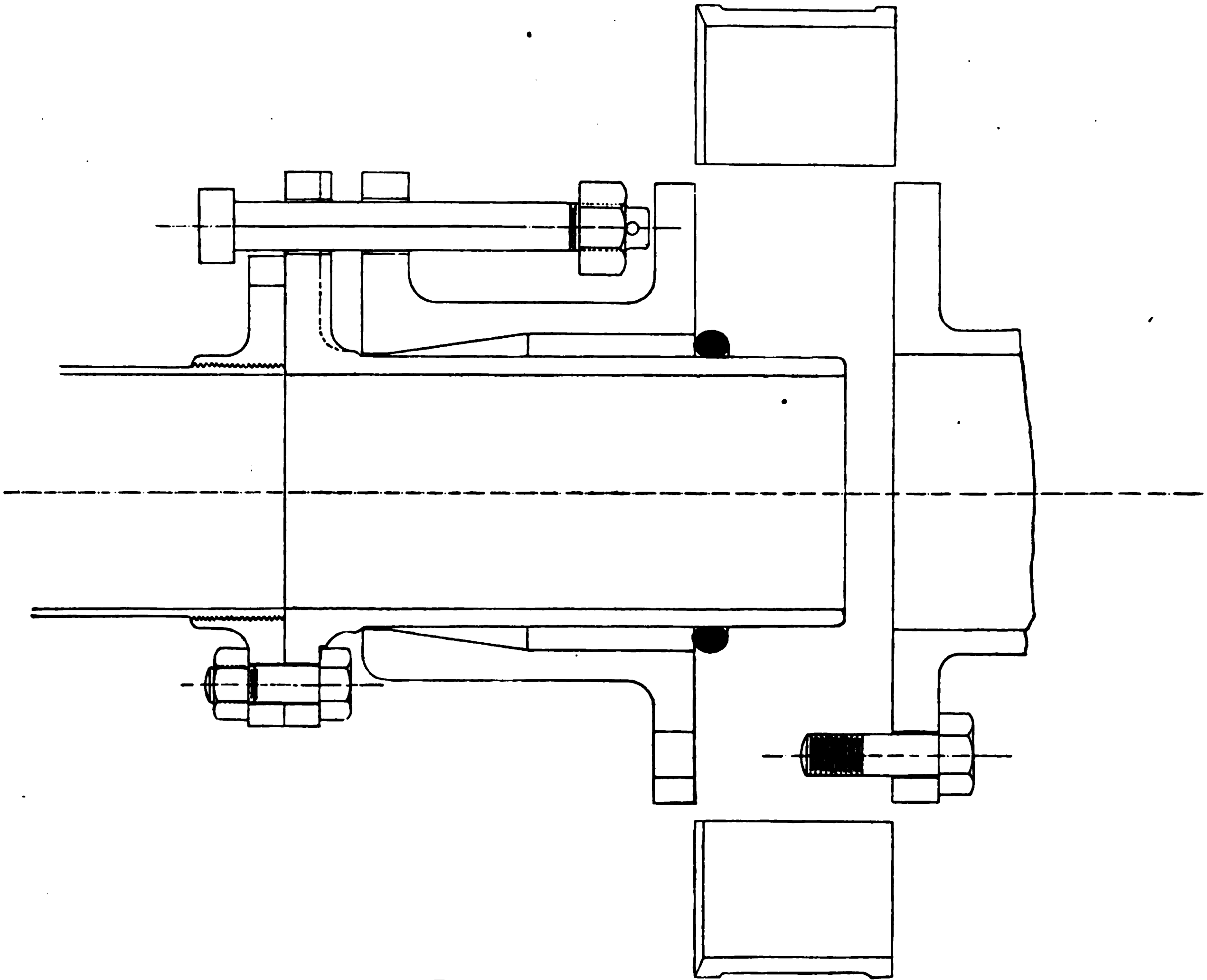
THERE have been two meetings of members held at the Institute of Marine Engineers during the month. The first meeting is reported on page 312. At that meeting the further experiments on the influence of the velocity of water on its absorbent power which were published in the *Engineer* were dealt with, and formally introduced to the members. And it was explained that more than one firm of engineers had written stating that similar results had been obtained in the course of their trials, and the results of the experiments had explained to them the meaning of their own results. The velocity of flow through the tube was certainly an influence, and affected the heat-absorbent power of the water. Mr. Williams carefully explained that, he did not say the conclusions were wrong. He had merely said the results did not sufficiently prove them. The second paper discussed was on the comparative performances of two steamers by Mr. McArthur. More data were given of two other steamers, but the conditions under which the vessels separately did their performances did not appear, and these doubtless vitiated the comparison considerably. A paper was read by Mr. Halliday on the Marine Engineers' Laboratory. Mr. Halliday's paper really took the form of an address on the advantages of a marine engineers' laboratory in raising the status of engineers in mental, moral, and social directions. He explained that the idea of such a laboratory was primarily put forward some years ago by Mr. Macfarlane Gray and Mr. Flannery, now Sir John Fortescue Flannery. The council of the institute has now stepped in and taken the idea up, and successfully launched it as a going concern. This paper may contribute considerably towards its initiation, and it will assist in every way possible by setting its advantages before the members at home and abroad. From Mr. Halliday's paper one gathers that there are 13 sets of apparatus got together, and that it is the place of the council as a whole and individually to build up a properly equipped laboratory for the members. The council has set the example. We are quite sure that the matter has only to be placed before the members for them individually to take part in getting apparatus together. This laboratory work has in a manner taken the place of the Education Committee's work. A certain sum was voted for that purpose. It may be supposed that the council will at least spend the same amount on apparatus during the twelve months. Then there is the scheme and the enormous influence of Mr. Macfarlane Gray and Sir John Fortescue Flannery to fall back upon. Within their initiatory idea for a laboratory they must have had some scheme by which they intended to fit up the building with apparatus. That scheme must exist to-day, and surely an appeal has only to be made for them to set in motion and provide apparatus to the extent of that provision. However, a sufficient number of associates has been found to go on with the three or four experiments in hand, and the apparatus for these has already been provided.



EXPANSION GLAND FOR STEAM PIPES.

We quote the following from the paper:—"After the matter had been considered, the council agreed to place at the disposal of the Experimental Committee three rooms of the institute building. It was a wise idea of the founders of the institute that they should try to create a feeling in the members scattered over the seas that they should consider the building in the Romford Road a kind of shrine. When they returned after many days the feeling would draw them towards it as the Arab is drawn towards his Mecca. To enhance this view the founders made it a rule that each member should give something of his own to the institute—something to which his name would for all time be attached. It has thus come about that engineers, as wanderers in distant parts, when they saw wonderful things, thought of the old place in Romford Road, and brought them home to be seen by the members there. During the year those at home, as well as those abroad, have directed their energies in a common groove, and have begun to furnish the apparatus for a fully equipped laboratory. The council and the committee, and the younger members, the associates, and the graduates are devoting time and work to the business, and with quiet persistence and energy on their part will soon have something to be seen by members when they come to the place. And the committee would suggest that each member of the institute should of himself put the rule in operation which recommends that each member should present something to the institute during his membership."

The laboratory being now in regular operation, we may proceed to the next step. The third-class certificate is still a matter in embryo. The full statement of the case has already been placed before the membership by Messrs. Sage and Adamson. The next step is to set the matter in motion. How can this third-class certificate be initiated? From the papers sent out by the Board of Trade, it is clear that a third-class certificate is very desirable. There ought to be an acknowledgment made to the young engineer that he is quite competent and a desirable person on board ship. On the other hand, it ought to be made quite clear that, when a young engineer does not hold a certificate from his superintendent setting forth that he is a competent and reliable workman, he should be looked on as an undesirable person on board a steamer. Our plan would be to make the granting of these certificates an institute affair. One talks about the status of the engineer. Our opinion is that if an engineer is a competent and reliable officer, his status may be left to take care of itself. But the status of the institute is a very different thing. It is the duty of the most humble member of the institute to promote its influence and status on every possible occasion. And what would promote its influence more than to make the institute the guardian of the standard of competency of the young engineers who are applicants to the Board of Trade for certificates of competency? It is for the council, then, to receive suggestions, to thresh them out, and to get into a working arrangement with the superintendents for the issue of certificates of competency to young men in shops ashore who may be willing or anxious to join the engineering staff on board steamships. We think we see a working plan; but it is for the council of the institute to set the matter in motion, and it will be better at this stage simply to offer these suggestions.



Expansion Gland for Steam-Pipes.

A contribution to the discussion on Mr. Halliday's paper on feed-heaters was read at the meeting of the institute on Monday, 24th September, which had been sent in by Mr. Northcott (member). Mr. Northcott says: "When economy is gained by using what would otherwise be wasted heat, the cause of the increased economy is clear. But when we warm the feed-water by means of live steam, or steam taken directly from the boilers, it is not at all clear why any saving should result from feed-heating. On the contrary, as most feed-heating arrangements entail a loss of heat by radiation, one might expect a live-steam feed-heater to lead to a loss rather than to a gain. If we get Peter to pay Paul we don't increase the sum of Peter's plus Paul's possessions. . . . . Mr. Halliday is apparently convinced that not only do live-steam feed-heaters lead to increased economy although no waste heat is utilised, but that when waste heat is used to heat feed-water the gain is greater than the amount of heat utilised by a further saving in the boiler, and due to the feed-water being hot instead of cold. He asserts that hot feed-water is 'in better form for receiving heat than is cold water.' Also that hot water 'absorbs more heat' than cold water." Both statements are somewhat nebulous. We should think that it is quite possible that hot feed water would be in better form to receive heat, since it was thermally more akin to the water in the boiler, and secondly, that it is quite possible that hot water might absorb more heat if it was in better thermal condition for doing so. Mr. Northcott goes on to say that "The author really means, I take it, that hot water absorbs heat faster than cold water." No, we hardly think that is what the author means, because hot water does not absorb heat faster than cold water, for his second paper proves that it does not do so. "Further on," says Mr. Northcott, "he would appear to think when a boiler is not receiving either hot or cold feed its circulation is normal and best, but that this normal and best state is disturbed less by the admission of hot than cold feed. If this be correct, it would follow that the heat going up the chimney will be least when the boiler is not being fed—that rather more heat will be wasted when hot feed is being introduced, and that the greatest waste of heat will obtain when cold feed is being introduced—even although the hot feed is got from live steam. Is there any evidence in support of this?" Mr. Northcott goes on, "Before most of the members were born it had been ascertained experimentally that the rate of transmission through so-called 'heating surface' increased with the rate with which the water was caused to flow past the transmitting surface. Very early experiments showed also that when the water receiving heat was at or about the temperature of evaporation the flow of heat through the heating surface was about four times as fast as when the absorbing water was at a low temperature." We are quite willing to believe that experiments were thought to prove this, only they did not. Mr. Northcott goes on to say, "I agree with Professor Elliott in thinking that 'mere velocity of matter apart from thermal and other conditions' would not increase the rate of absorption." Is the paper on mere velocity of matter? It is on feed-water *heaters*. Newton dealt with velocity of matter years ago. This paper deals with the velocity of matter with thermal and other conditions thrown in. And in no instance is velocity of matter discussed in the paper apart from "thermal and other conditions." Mr. Northcott goes on to say, "A good circulation clears away the particles of water that have received heat from the 'heating surface,' and the steam bubbles that may have been formed thereby, and gives other particles of colder water the chance of warming themselves by absorbing heat drawn from the plate." The words "a good circulation" is a qualified phrase, and very acceptable. We are not now led to believe that the more rapid the circulation the better. "A good circulation" is now sufficient. The editor of the *Engineer* puts it this way:—"Should the surface of the plate be not wet, the absorption is defective. On the other hand, circulation in itself is injurious. The circulation should only be sufficient to keep the plates wet. When the circulation is just sufficient to make them wet, the absorption is then at its maximum" This idea appears to be borne out by Mr. Halliday's experiments. The attendance of members at the Institute during the daytime is inconsiderable; yet the provision made for this runs considerably into the annual income.

EASTON, ANDERSON, AND GOOLDEN, ERITH IRON WORKS.

It was in 1864 that Dr. William Anderson, C.B., F.R.S., laid out the works of the above company, and the site was certainly well-chosen, both from its river frontage and because of its proximity to the South-Eastern Railway system—perhaps, though, this latter is of doubtful advantage. From London to Erith is a distance of 13 miles, and the time taken by the train to travel this distance is about an hour, more or less. We have heard and we have read curious things about the goods traffic on this system, and lately, we believe, a coal train has been entirely lost, and, although known to be missing for some weeks now, it has not yet put in an appearance. But the Thames, which is just a mile wide at Erith, is of unquestioned advantage. Most heavy machinery and boilers can be simply run out by travelling crane above the boat and lowered into it without the least trouble. The main gate to the works is about half-a-mile from Erith Station.

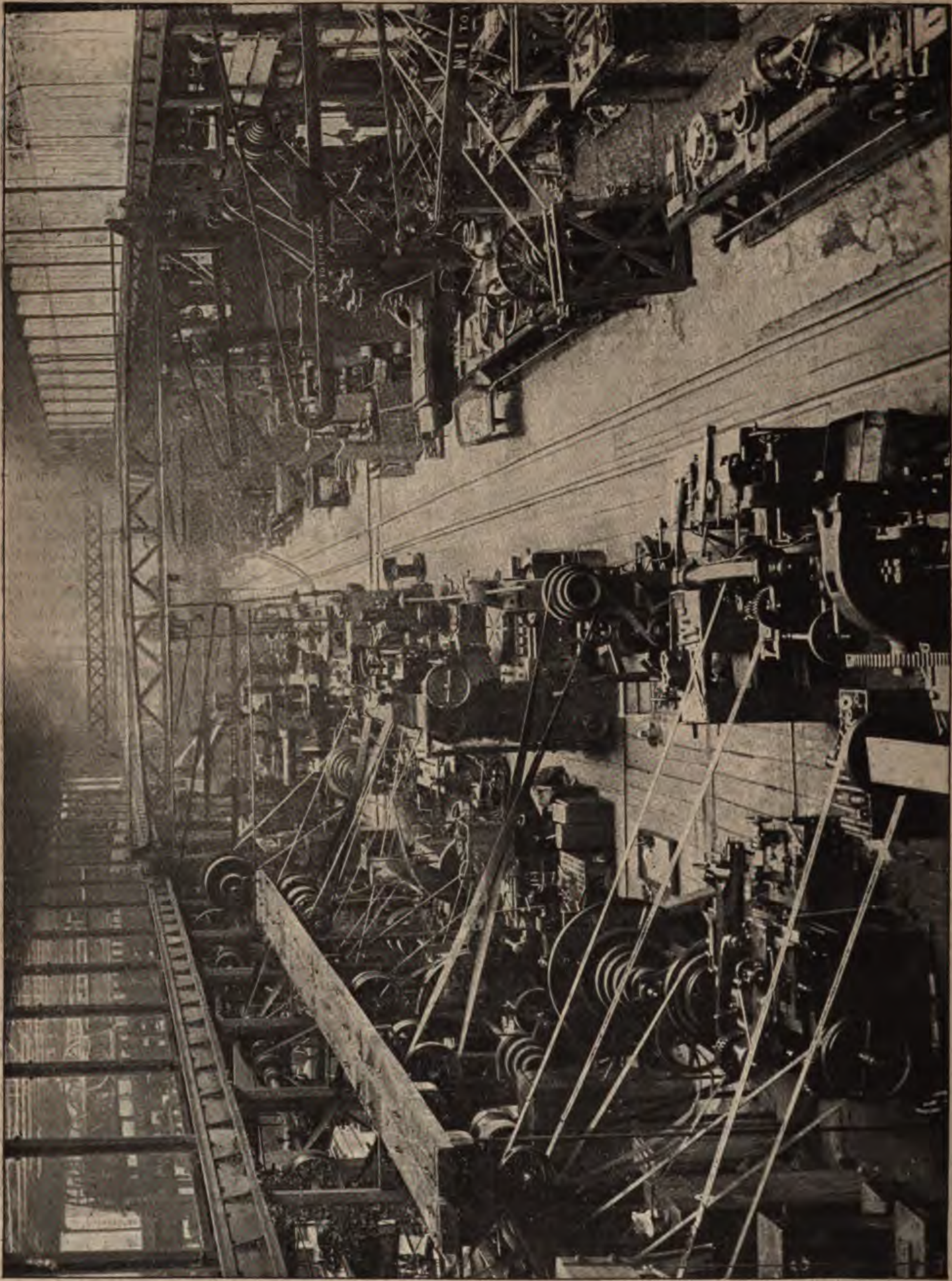
The original works of the company were at the Grove, Southwark, but gradual extensions were made at Erith, until in 1873 the Grove Works were closed, and the machinery and tools were moved down to Erith. The extent now of the works is 17 acres, and the river frontage is 800 ft. The works are entered through the offices. On the ground-floor of the offices are the clerks' and manager's rooms, and above is the drawing office, which has accommodation for 44 draughtsmen, and at present there is a full complement. In the offices there are also an estimating, electrical, and photographic rooms.

The shops are built with their direction running towards the river, so that the travelling crane can work out on a gantry over boats and barges. The main building consists of six equal spans 43 ft. wide and 600 ft. in length. The two middle spans are fitted up as machine and erecting shops, and the roofs of them are carried up so as to give plenty of head room for building large engines. The high traveller rails are 39 ft. from the floor level. At the present time when one enters they see numbers of hydraulic lifts being fitted up. These are for offices and mansions; one was for Queen Anne's Mansions. A number of electric lifts are also in process of erection for the South London Railway. Further along a number of compound vertical tandem engines are being constructed and erected. The circulating pumps and engines for H.M.S. *Aboukir* and *Cressy*, now building at Fairfield, are being constructed. At the end of the shop there is a testing room, and the ventilating fans and engines built in the shops for the Fairfield Works were being tested. As the working pressure was 300 lbs., and the pressure at the time was only 140 lbs., the fans and engines were not seen at their best. Still they worked very smoothly. Amongst other things being constructed and lying in this erecting shop were a number of sluice gates for Chatham Dockyard, vertical pumps for well sinking at Madrid, pumps for the Brush Company's works, also large beam engines for Sutton Waterworks.

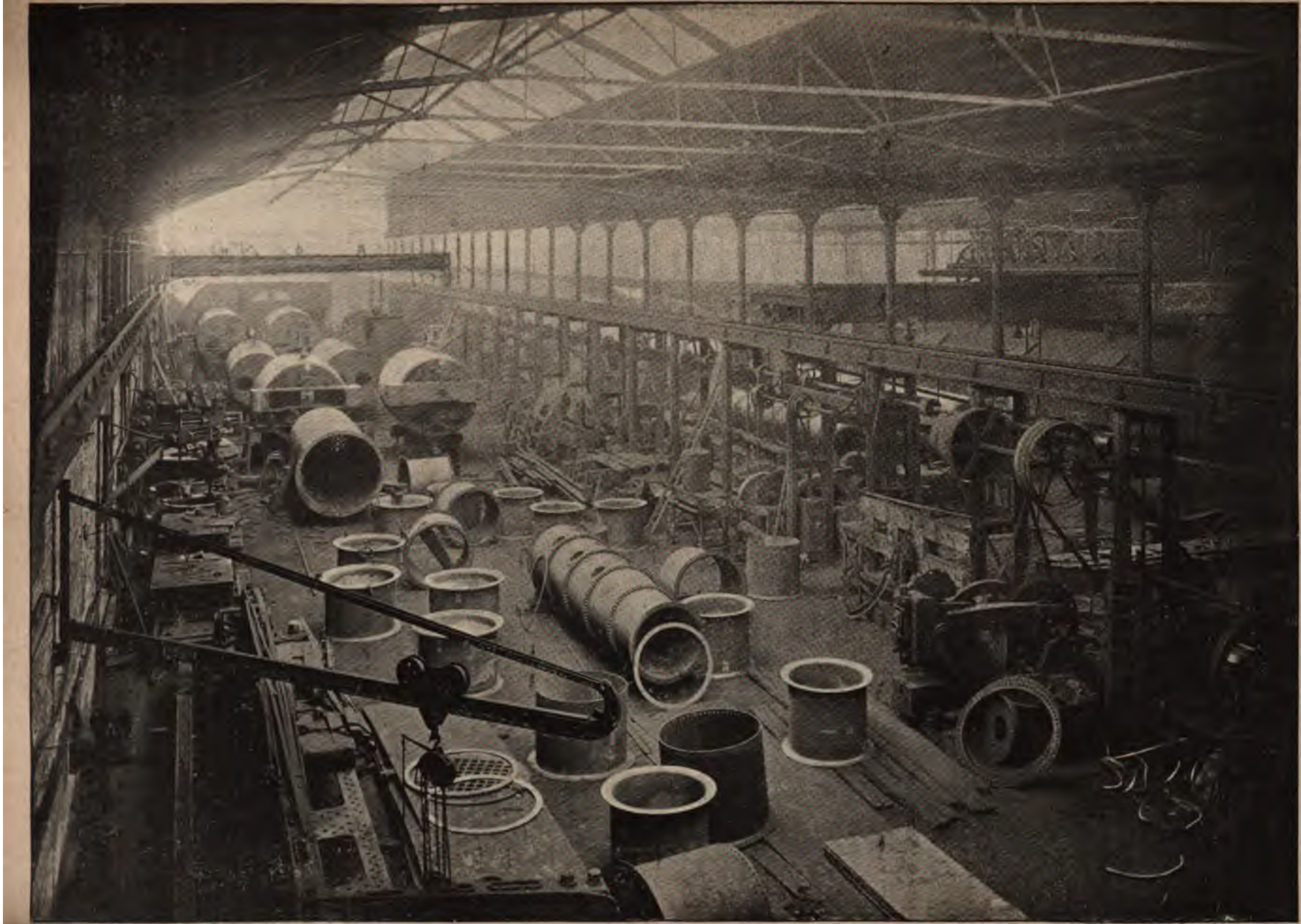
The erection of the machines under construction was going on in the middle of the floor, but ranged along the walls and next the pillars were machine tools. Some of the machines were very large and could take in work of great dimensions. There was a huge lathe with 30 ft. bed, another huge horizontal lathe with 18 ft. wheel, two or three large planing machines with about 20 ft. travel, and the crosshead carrying tool is 6 ft. rise above the table. The Sutton engine was of large size, the shaft being 18 in. diameter. The piston rings for the circulating pump engines were of Sir John A. Durston's own design. They were ordinary split rings, but with a recess at each side. They were turned for a 1·64 in. wear, and when this was worn down the shoulder of the recess came against a corresponding shoulder, which prevented the steam which had leaked into the inside expanding them further and increasing the friction.

The machine shop engine is of the beam type, and like all this kind works very smoothly. In the same room are two engines driving dynamos for supplying current to the electric cranes. The dynamos have an output of 105 volts, 500 amperes, and the speed is 750 revolutions. Four Cornish boilers supply steam to the shop engines and the steam hammers. Three of the boilers are for the shop engines and for trials and one for the smithy.

The two bays towards the east of the erecting shop



Machine Shop, Messrs. Easton, Anderson & Goolden, Limited, Erith Ironworks.



Boiler Shop, Messrs. Easton, Anderson & Goolden, Limited, Erith Ironworks.

are used for boiler making. This shop is fitted with the usual fires, flanging plate rolling machines, and hydraulic rivetters. Further east two sheds have been erected with overhead cranes, under which frame-and-lattice work is made. The moulding shop and smiths' shop are in the two bays to the west. In the moulding shop there are three cupolas, and castings are made up to 20 tons in weight. Many of the cylinders cast in the works are very large and they are loam castings. Everything going on in this shop appears to be of massive descriptions. There is an overhead crane capable of lifting 20 tons.

The electrical shop is towards the west, and two boilers of the locomotive type supply the steam to the engines. These engines are horizontal and run at a speed of 300 revolutions. A number of dynamos were under construction for slate quarries, and two rather large (110 kilowatts) for the lighting of Pembroke town. Two had just been completed and were under test with the engines in the erecting shop. There are two electrical shops: one where the winding of bobbins and armatures is going on, and the other for turning the iron parts of the machines. Fifteen motors for the South London electric lifts were under construction. A neat little machine was in operation for stamping out armature disks. The pattern shop is large, as was to be expected from the variety of the work always in hand and the consequent variety of patterns.

M. Björnstad said they did not take in hand poor work. The men usually worked to gauge and to a nearness in fit of 1-10,000th of an inch. The consequence was that Government and local authorities could rely on the work turned out. The engines coupled to the dynamos for Pembroke town are triple-expansion and enclosed. About 10 gallons of oil is poured into the base of the engines, and after flowing through a strainer it is pumped at 25 lbs. pressure into all the bearings. Although the speed is 400 revolutions per minute, an engine of the same type had been known to run without stopping for three months, and when examined the tool marks had not been worn out of the bearings. The engines for the Leicester Corporation Waterworks were constructed at these works. They were of the triple-expansion inverted cylinder type, with cylinder 17, 27 and 24 in. diameter respectively, the stroke being 3 ft. and the steam pressure 120 lbs. per square inch. Three pumps of the plunger type beneath the cylinders were 12¼ in. diameter and 3 ft. stroke. The air, feed, and circulating pumps are worked off the main engines. The pumps were: feed pumps 2 in. diameter; air pump, 11½ in. diameter; and circulating pump, 6 in. diameter. The working speed is 25 revolutions per minute. There were three trials, each lasting 12 hours. The steam used was ascertained by weighing the air pump overflow; the water condensed in the cylinder jackets, and the water from the cylinder and valve chest was also included in the air pump overflow. The head of water in the pumps was taken from the engine-room pressure gauge, which was afterwards tested against a mercury column and the results corrected.

During the trial complete readings and diagrams were taken every hour; they were taken separately both by the staff of the Corporation and by that of the contractor.

THE CLYDE PASSENGER PADDLE STEAMER "WAVERLEY."

TO the noble fleet of swift passenger paddle steamers which, season after season, ply on the waters of the Firth of Clyde, connecting the various and often remotely situated watering-places with the several railway termini of the three great railway systems, only one addition was made this year, but in herself very noteworthy. This was the paddle steamer *Waverley*, an accession to the flotilla owned and worked by the North British Railway Co., of which we have pleasure in giving an illustration herewith.

Like her immediate predecessors in the North British fleet the *Waverley* is the production of Messrs. A. & J. Inglis, of Pointhouse Shipyard and Warwick Street Engine Works, Glasgow. All the vessels turned out by this firm for the same service—and their connection with the North British Co. has been a close one from the very beginning, they having built an earlier vessel of the same name as far back as 1865—have been remarkably successful; but the *Waverley*, added to the fleet in July of this year, has—as it was designed to do—excelled them all. She is of much larger dimensions than any of the other boats of this company's fleet, and ranks indeed amongst the largest of the pleasure steamers on the Clyde. Not only so, but she has been designed and engined to secure and maintain great swiftness; and the results of her services so far have proved such as to place her in the very front rank of swift paddle steamers, power, length, and displacement considered. On the occasion of the official speed trial on the measured mile in July she attained a speed equal to 19·73 knots an hour; and notwithstanding that this surpasses the speed of any vessel of her size plying on the Firth of Clyde, both on the official trial and in subsequent service, this high rate of speed has been unaccompanied by even the slightest vibration or other discomfort.

The *Waverley* is 235 ft. in length, 26 ft. beam, 8 ft. 6 in. deep, and has a tonnage of 448·5 tons gross register. She is licensed to carry 1,500 passengers. She has been plying from Craigendoran round the Island of Bute, besides taking part in the general service of the North British Steam Packet Co.'s system. The accommodation of the vessel has been arranged with the view of providing the utmost possible comfort for all classes of passengers. On the upper deck there is a wide and uninterrupted promenade extending almost the entire length of the vessel. The deck saloon is a spacious, admirably lighted and elegantly furnished apartment; and the dining cabin is another exceedingly handsome and well-appointed interior. In the fore part of the vessel there is also a series of well arranged and commodious cabins.

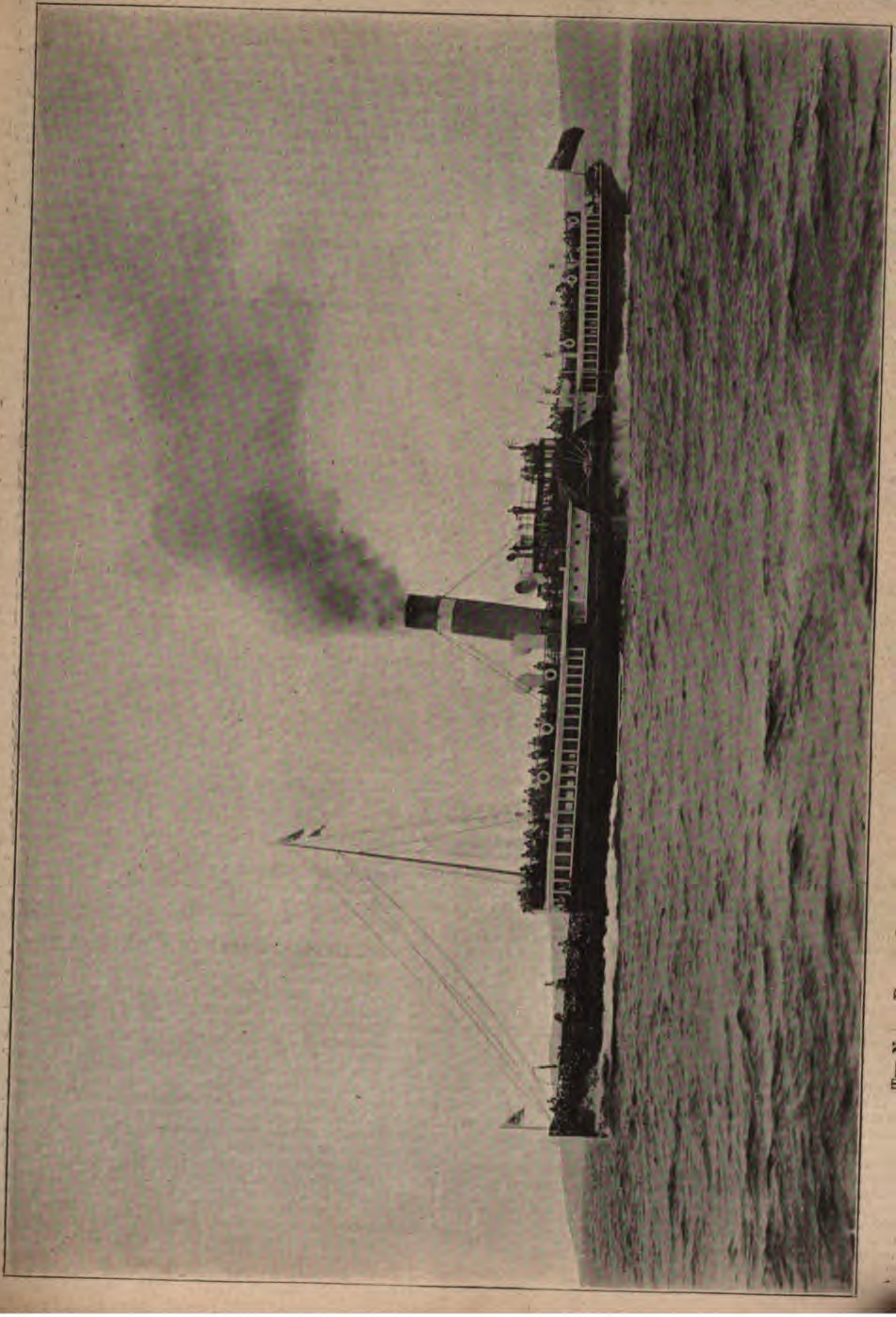
The *Waverley* is propelled by diagonal engines of the compound type, the departure from the single type of engine in this instance being one of many other indications of the spirited policy which the North British directors are evincing in ordering steamers of the very highest class suitable for the requirements of their extensive and extending service.

THE SHANGHAI ENGINEERING. SHIPBUILDING AND DOCK CO.'S "ORIENTAL" DRY DOCK AND WORKS, SHANGHAI.

THE Shanghai Engineering and Shipbuilding Co.'s fine graving dock, which has been constructed under the personal superintendence of Mr. J. Blechynden from the designs of Captain J. P. Roberts, was opened on June 1st. The dimensions are:—

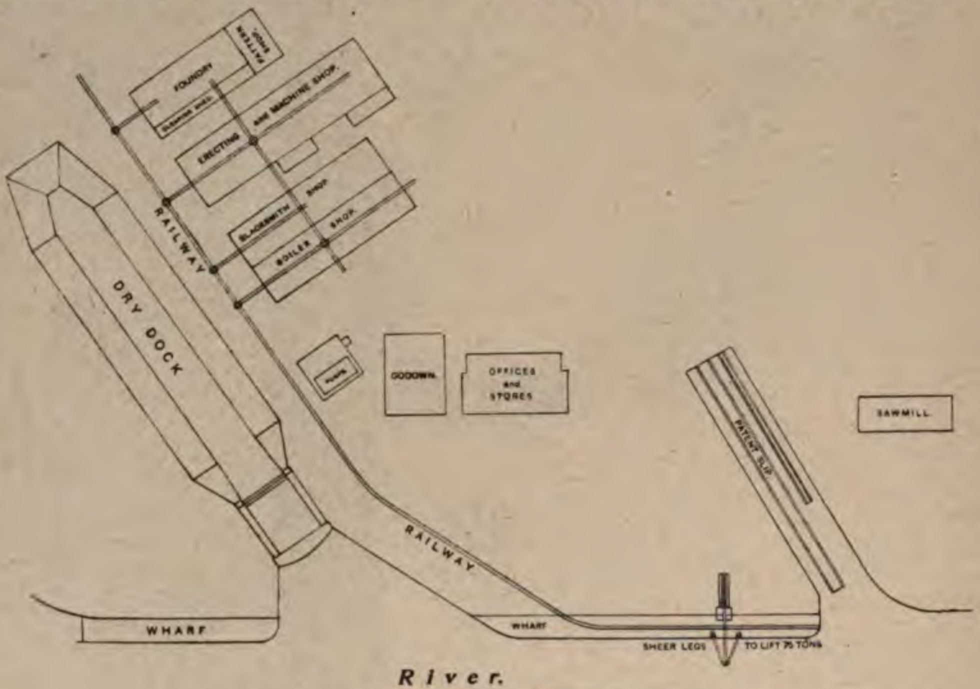
	Feet.
Length on blocks from outer caisson	526
Length on top	571
Width on bottom	54
Width on top	128
Width of entrance on bottom	64
Width of entrance on top..	80
Depth of water on sill	24

The property has a frontage of 2,000 ft., with a depth at low water springs of 26 ft. alongside, and extends 1,000 ft. to the rear. The dock strikes the wharf frontage at an angle of 45 deg., thus materially affecting the facility of docking. The blocks, each standing on six piles, are driven close together and



THE NORTH BRITISH STEAM PACKET CO.'S P.S. "WAVERLEY," BUILT BY MESSRS. A. & J. INGLIS, POINTHOUSE, GLASGOW.

placed every 4 ft., to the inner chase. The caisson, which serves both chases, is of wood well braced and bolted, being of a new design, which enables the laying of trolley lines over its deck, as it is intended to establish a complete trolley service over the whole of the estate for the purposes of economical and rapid transport of heavy material. The bed of the dock has a width of 75 ft. and is of concrete 7 ft. thick, of which some 12,000 tons have been used, the whole being covered with 3 in. deals securely bolted. To form some idea of the magnitude of the undertaking, we may mention that underneath this concrete are about 3,500 12 in. square piles averaging 24 ft. in length, which are driven in about 3 ft. apart. On these are firmly bolted 24 longitudinal stringers, upon which are, likewise secured, over 100 transverse stringers of the same material, the whole of the stringers being embedded with the concrete. The bulkheads at each gateway, which are absolutely water-tight, are formed of tongued and grooved piles 12 in. square, driven 20 ft. below the sill and extending at the chase piles 40 ft. into the sides. The sides of the dock are supported by heavy baulks firmly braced back and forming the usual steps all round.



"Oriental" Dry Dock and Works, Shanghai.

The dock is drained from two waterways running fore and aft, and 6 ft. each side of the centre line, thus being well clear of the keel blocks. The pumping out of the dock, which can be accomplished in 2½ hours, is done by two centrifugal pumps respectively, of 22 in. and 27 in. diameter, driven by an ordinary compound engine. In case of accident a second engine capable of working the 27 in. pump stands close by. For the ordinary draining of the dock a 10 in. centrifugal pump has been provided. On the southern division of the wharf frontage will shortly be placed a pair of steel sheerlegs, with a hoist of 27 ft., and capable of lifting 75 tons, a weight which is hardly likely to be required at Shanghai.

The buildings, which stand prominently on the southern section of the company's premises, namely, the machine, boiler, and fitting shops, through which the trolley lines run, are of the most improved design, everything being calculated from an utilitarian and economical standpoint, and enjoy the advantage of containing the latest improvements known to engineers. The machine shop, which measures 260 ft. by 66 ft., has two lathes of 54 in. and two of 44 in. centres, with a 46 ft. bed; when connected a shaft of over 70 ft. can be turned. Special lathes are also to be found for the turning of shaftings, pulleys, &c. Several planing machines, the largest of which is capable of running over a surface of 14 ft. square. Of drilling machines may be mentioned a large horizontal machine of the most improved type, capable of covering an area of 8 ft. by 10 ft. without moving the material, and a radial machine with a radius of 10 ft. In addition to these are the many machines, such as the band and circular saws for the cutting of cold steel, slotting, wheel-cutting, &c., to be found in every well-appointed shop. The boiler shop, with an area of 240 ft. by 75 ft., boasts of a drilling machine capable of negotiating a boiler with a diameter of 15 ft., and a plate edge machine, with a 24 ft. range. A complete set of hydraulic riveters ready for rivets of 1¼ in. diameter, and a set of masting rolls and other appliances. In the blacksmith's shop is a four-ton steam hammer, in close proximity to blowers and furnaces for the forging of shafts 16 in. in diameter. Also foundry plant which includes three "Rapid" cupolas and large brass furnaces. The pattern shop is also well appointed, and up-to-date with every requisite. The illumination of the dock and several buildings is intended to be amply provided for, there being no less than 57 arc and 220 incandescent lamps, contracted for by Messrs. Mandl & Co., the same to be fitted by the Oriental Electrical Co.

A slipway, with a cradle capable of carrying a vessel of 350 tons weight, and which will be hauled up by a steam winch, intended also for the hoisting at the sheerlegs, will be shortly completed.

INSTITUTE OF MARINE ENGINEERS.

The winter session of the Institute of Marine Engineers opened on Monday evening, September 11th, at 58, Romford Road, Stratford, E., Mr. A. Boyle (chairman of the council) presiding.

The Chairman said that in opening the forthcoming session they might congratulate themselves on the favourable auspices under which they were starting their winter meetings, which he trusted would be a great success. They had one paper ready to be discussed, and promises of several more, and he believed they would have some instructive meetings. That evening they resumed the discussion of two papers which had been read, and to a certain extent discussed. These were "Experiments on the heat absorption power of water," by Mr. George Halliday, and "A comparison between the performances of two steamships," by Mr. J. D. M'Arthur. The first-named was a series of results of experiments made by an apparatus kindly presented by the editor of the *Engineer*. Mr. Halliday had elicited a very important principle—that the heat absorption of water was increased and the evaporative efficiency of a boiler was increased by the rapidity of circulation up to a certain point, and that when this was reached the evaporative efficiency decreased. These experiments had been continued, and he now asked Mr. Halliday to explain what he had ascertained.

Mr. Halliday said that during the discussion a very important point was brought out by Mr. Macfarlane Gray—that when the velocity of the water got up to a certain point there was a maximum of absorption of heat by water. The first experiment he made he thought proved this fairly well, but Mr. Macfarlane Gray pointed out that he did not furnish sufficient data to prove that the rate of absorption failed after a certain velocity had been reached; that in one or two cases he had two points, and in another one point. He, of course, maintained that in every case there was a full absorption point, and that in no case was there a straight line showing that the amount of heat remained the same, whatever the velocity might be. Seeing the position Mr. Macfarlane Gray took up, he made careful notes and readings of what took place when the velocity reached a certain point where the absorption power fell. These results he had published. On the first experiments he simply got a hint that such a thing existed; on the second there was absolute certainty that such a thing did exist—that a maximum absorption of heat did take place, and that it depended on the amount of heat offered to the tube containing the water. When using the Fletcher burner he did not turn on the gas full; he allowed an easy burning row of gas to work on the tubes. In that case he had the maximum when the rate of flow was 100 cubic centimetres per minute. Then he turned on the heat further, and the maximum point came when the velocity of the water was measured by about 200 cubic centimetres per minute. He then put on two gas metres so that the tube was entirely enveloped by flames, and in that it was about 500 cubic centimetres. In each case he used the same tube, and the water was measured by what flowed right through. Since this was published the maker of a feed-water heater wrote him that this feed-water heater depended on the principle of pumping the water through a series of tubes at different speeds, and he found that under certain circumstances it would heat the water more than in others. That gentleman's argument was that the feed-water heater was the best, but he would not say that because the feed-water heater allowed the speed of the water to be regulated as it came through the pipes, therefore it was the best. Another firm had coincided with certain results that had been obtained.

Mr. Williams remarked that the objections he made on the last discussion had not been answered. An impression had got abroad that he was objecting to the proposition put forward by Mr. Halliday, whereas he repeatedly said he did not object to the proposition. There might be a maximum co-efficient transmission of heat to water dependent on the velocity on the surface, but his objection was to the evidence. It was simply a question of evidence, and the fact of Mr. Halliday thinking the second experiments necessary to put before them was sufficient to prove that his statement was correct.

The Chairman thought it was not necessary to go beyond the scientific value of the experiments made at the institute, and he was sure every opportunity would be given to members to see these experiments. It was unnecessary for him to give any definite opinion.

Mr. Halliday said really there was no difference in the figures in the paper now before them. Further experiments showed that they could not be disproved. Again, experimental results by a person of 20 years' experience had never been questioned; they had always been taken as correct. They might question a machine which someone had invented and said would do a certain thing, but the results he had never heard questioned, and these results were entirely as they stood before. With regard to the point that these results were felt necessary because of the discussion, he entirely disagreed. They were different results altogether. The first results were made with steam as a heating agent, the temperature of which was never over 300 deg.; the second results were obtained by heating a copper tube by means of gas, the temperature of which was something like 2,500 deg., and in the second case they got much better results. He had spoken with two or three prominent engineers on the matter, and they did not question the results at all.

The Chairman said he had spoken to Mr. Macfarlane Gray, and he had given every credit for the work done. It was very creditable to the institute that they were able to conduct experiments such as this on the premises. The council looked upon this as a very important part of the educational work which he hoped they were doing as regarded marine engineering. They had 13 sets of experiments, and he might suggest that a testing machine would be a very valuable acquisition.

The discussion then closed.

With regard to the second paper, "A comparison between the performances of two steamships," the hon. sec. (Mr. James Adamson) said one well-known member, in the course of correspondence on the paper giving a comparison between two steamers, had forwarded some particulars and results gained from two other steamers termed A A and B B :—

PARTICULARS.	A A	B B
Length between perpendiculars ..	345 ft.	330 ft.
Beam	46 ft. 6 in.	46 ft. 6 in.
Load draught ..	22 ft. 4 in.	20 ft.
Deadweight capacity	5,800 tons.	5,000 tons.
Diameter of cylinders	17 in., 24 in., 32 in., 42 in., 42 in.	17 in., 24 in., 32 in. 42 in., 42 in.
Stroke of pistons ..	42 in.	42 in.
Revolutions at usual speed	67	62
Average I.H.P. ..	1,240	1,050
Diameter of propeller	15 ft.	15 ft.
Pitch do. ..	17 ft.	17 ft.
No. of boilers and pressure	Two 260 lb.	Two 250 lb.
Mean diameter and length of ditto ..	13 ft. by 10 ft. 6 in.	11 ft. by 10 ft. 6 in.
No. and diameter of furnaces	Three, each 3 ft.	Three, each 3 ft.
Type of donkey boiler	Marine	Marine
Nature of draught	Ellis & Eaves's	Ellis & Eaves's
No. & size of winches	Seven 8 in. cylinders	Seven 7 in. cylinders
Dimensions of fan engine cylinders	Two, 8 in. by 12 in.	Two, 8 in. by 12 in.
Type of feed pumps	Weir's and ordinary	Weir's and ordinary
Do. do. heater	Weir's	Weir's
Do. evaporator ..	Mudd's	Mudd's
Steering engine ..	Davis's	Davis's
Total No. of auxiliary engines, including pumps, ash hoist, winches	12	11
Average speed ..	9·15 knots	8·5 knots
Average daily consumption of good Welsh coal ..	14·4 tons	13·10 tons
Average consumption per I.H.P. per hour	1·07 lb.	1·15 lb.
Average consumption per ton carried per mile ..	·0249 lb.	·0294 lb.

The Chairman said there were a great many points of detail which should be carefully considered. It showed how largely the cost for doing the same work was increased in one ship owing to lack of attention to details. It laid particular stress on the losses occasioned by the use of high-pressure steam for small auxiliary engines.

Mr. Ruthven said that on the last occasion, Mr. Adamson gave them figures, which were much more valuable after years of experiments than these isolated cases. The difficulty was to separate the ship from the engines, the engines from the boilers, and the boilers from the *personnel*.

A member thought it would be necessary to have a series of voyages, and ships running in the same weather, to make these experiments properly.

Mr. Maclaren pointed out that there was a difference of two feet in the diameter of the boilers, and that would increase the ship's weight.

The Chairman said the engineer as a rule had not much control of the ship or of the weather. All he had to do was to get as much power out of the coal he used as possible.

Mr. Ruthven observed that auxiliary engines of ships in the Navy were being fitted with special evaporators to take the steam from the auxiliary engines and pass it through a special condenser.

The Chairman thought it would be an advantage to use it in that way. The paper was certainly a credit to the author, and it might be further discussed.

The Hon. Secretary said the whole point seemed to be, what is the economy of the five-crank engine? There was a great deal of valuable matter behind this.

The discussion was adjourned, and a vote of thanks to the chairman for presiding concluded the meeting.

ELECTRICAL NOTES.

(*From our own Correspondent.*)

OUR electric launches require secondary batteries for storage work, and the very light one used on the street railway line of Ghent may come in of use. The car takes 108 cells, which together weigh about two tons, and these are sufficient to drive the car 35 miles. A launch would probably take about half this weight, and the weight then would be equivalent to a displacement of 20 cubic feet of water. The peroxide of the positive element of the cells is formed electrically. The positive electrode consists of a block built of many horizontal layers of corrugated lead sheets. These sheets are laid with the adjacent corrugations at right angles to each other, so as to give numerous channels and a large space to be filled with peroxide. The plates are turned together at the corners, and the whole then becomes a block. Nine holes are bored in the plates at right angles to the surface, and the negative electrode, which consists of nine cylinders, goes into these holes. These cylinders are formed of perforated lead piping containing the negative action mass in the form of porous spongy lead. The negative cylinders are held out of contact with the positive block by means of perforated hard rubber insulating jackets. Each cell when discharging at the rate of 15 amperes has a capacity of 300 ampere-hours, and when discharging at 50 amperes has a capacity of 250 ampere-hours.

Washington Experimetal Tank.—The special machinery for the experimental tank at Washington has just been completed. Congress appropriated £20,000 for its construction. All the mechanism installed is electrical. The carriage for towing the wooden models rests on eight wheels, and spans the whole width of the basin, and is driven by four electric motors, and these can get up a speed to the carriage of 2,000 feet per minute. The armatures of the motors have a speed of about 800 revolutions per minute, and are fully capable of taking the full load for five minutes. The carriage weighs 23 tons, and its speed is varied by a controller for the current coming from the station, and also by cutting out or in the several driving motors. Forty-five different speeds can be given the carriage, ranging between 0 and 2,000 ft. per minute. There are two brakes to the carriage, independent of each other. One consists of two strips of iron, one on either side. These strips are pressed together by hydraulic cylinders, whilst a slipper on the carriage tends to force them apart. The other is an hydraulic brake, which consists of a cylinder and piston located in the water of the tank, the piston being connected to the carriage by means of a cable and hook. There is also a dynamometer, which records the pull of the models through the water. The forward end of the spring of the dynamometer, to which a bracket is attached, is moved forward or backward by an electric motor. This spring measures the resistance of the model. Two electric-driven centrifugal pumps discharge the water from the tank. The tank contains 1,000,000 gallons.

The Holland Submarine Boat.—An elaborate series of tests are being made with this boat at Little Peconic Bay, Long Island, by United States naval officers. The first tests, it will be remembered, were made about a year ago in Staten Island Sound, and since then the boat has been completely overhauled, and several changes have been made in her machinery. Little Peconic Bay was selected because of its level bottom, and because of its quietness. The principal test will be over a two-mile course, and will consist of diving and running under water, running awash, and the discharge of torpedoes. She has already been noted to dive below the water in from five to ten seconds. She is now equipped with a 150 H.P. gasoline engine, which propels the boat when running on the surface, and it also drives a 50 H.P. dynamo for charging the storage batteries, which weigh in all some 40,000 lbs. Compressed air works the storage engines, and discharges the water from the submerging tanks when the vessel is to be brought to the surface. The air pressure is 2,000 lbs per square inch, and it is supplied to the storage engines through valves which reduce the pressure to 50 lbs. The gasoline carried gives her a cruising radius of 1,500 miles at a speed of six miles an hour. It is said to make better time under water than on the surface.

Electrical Measurement of the Oscillation of Ships.—This instrument is made on the gyroscopic principle. It consists of a small electric motor mounted in gimbals, like a ship's compass, with its armature running in a vertical position at high speed. As the ship rolls the armature maintains the original direction of its position, whilst the frame supporting the gimbal rings follows the motion of the ship. There are scales and pointers for indicating the oscillation.

Electric Siren.—Mr. A. G. Trudeau, of Ottawa, has invented and constructed an electric siren. It consists of two large funnels made of ¼ in. copper. Each of the funnels projects 6 ft. 6 in. from the stand at right angles to each other. In each of these funnels a vibrator is placed, the object being to use alternately or simultaneously. The diaphragm is secured in a frame by a circular clamp, and acts like the ring of a drum on the skin The amplitude of the vibration is regulated by a screw at the middle. Electromagnets made by laminated cores are fixed in the frame. The horns project from a large hollow sphere mounted in the stand. The sphere is in two parts, and the vibrator is self-contained and can easily be replaced. It is worked by alternating currents.

Wireless Telephony.—Marconi has brought his system of wireless telegraphy to considerable perfection, and now we have Sir Wm. Preece bringing in a system of wireless telephony. The experiments have been made near Carnarvon. Four high poles have been erected near Llanfaglan Church. At a distance of half-a-mile four similar poles have been put up. A high pole has been erected at Belan Fort, half a-mile further on, which supports a coil of wire, one end of which is dipped in deep water. Sir William has been able to send between these points the sound of taps, and it is his intention to introduce the Morse system. Messages have been sent, and the system enables the messages to be sent much more quickly than by Marconi's.

HOW A BROKEN SHAFT WAS REPAIRED.

(BY W. J. PAGE, 2ND OFFICER).

THE *Perthshire* left Sydney on the 26th April with 1,200 tons of frozen meat and 600 tons of produce, bound for the Bluff, New Zealand. We experienced strong S.E. gales from the day we started until the 28th April, and then the weather moderated. At six p.m. on that date the tail-end shaft broke. The ship was then about 391 miles S.E. of Sydney, latitude 38 degrees 37 minutes S., and longitude 156 degrees 48 minutes E. All sail was at once bent, and it was set that night with the hope of sailing or drifting towards Sydney. The sail, however, proved useless; the ship would not even steer with every stitch of canvas that we could put on. Then there remained nothing for us to do but to drift in the hope that shortly some vessel would sight us and take us in tow. On April 30th the engineers on board turned to to ascertain the exact vicinity of the break, and came to the conclusion that it was too far aft to allow them to connect with the coupling. So all idea of temporary repairs was abandoned. Now there commenced on our part a series of daily driftings whose like has never been previously recorded in this vicinity. We tried all means and ways of tacking or wearing ship, but we never succeeded. We encountered gale after gale, and this drove us more and more in varying directions, but generally to the north-east. So as to alter the vessel's course, or at least get her head on to the seas, we rigged heavy drags over the stern with as much as 180 fathoms of line, but all to no purpose. We could not alter her course at all. These drags, after repeated trials, were given up as useless. On May 13th we sighted the timber-laden schooner *Whangaroa*, from New Zealand. The skipper came aboard, got all information as to our position, and the manner in which we were drifting, and promised to tell any steamers he met. From the time he met

THE NEW … PUBLIC LI… ASTOR, LENOX, TILDEN FOUNDA…

us till May 21st we had comparatively calm weather, though all the time our general drift was to the north-east and further away from our port, that is to say, from Sydney. On May 22nd there commenced a series of gales lasting a week, and blowing from all points of the compass in succession with mountainous seas. The ship was in splendid trim and behaved very well, although she rolled very heavily and strained considerably. On the 25th May, in the height of the gale, we spoke to the barque *Northern Chief.* This was the second vessel we had seen in 30 days, although a topsail look-out was kept night and day. By Sunday, 28th May, we had travelled in all 930 miles in a straight line. Of course the actual distance covered was much greater, and our direction also taking it in a straight line was north-east from the point where we broke down. The course had been zig-zag, and sometimes altogether backwards, but the latter was not frequent,

During all this time rockets and other distress signals were sent up whenever we came to within 30 miles of a steamer's track, but it was all of no use. We were now out of the regular track of all steamers between New Zealand and Australia, and were drifting in a direction which would take us into the unpleasant vicinity of the South Sea islands and their dangerous coral reefs, and into waters which are unfrequented by ships save perhaps an occasional schooner, which to us would be useless, because by the time she had reported our whereabouts to any Australian or New Zealand port we would be from 100 to 300 miles from the spot, and our manner of drifting would be unknown. As a last resource it was decided to break away the stern tube, and endeavour to couple the broken shaft. 200 small holes were consequently bored into the tube in such directions as it was wanted to split. At the same time chains were with great difficulty passed round the propeller outside the ship, and after the gear had carried away twice it was eventually lifted into its proper position. The approximate weight of the propeller is 13 tons, so that you can see that it was no easy matter. Parcelling was also got round the propeller shaft, so as when heaving it into the hold we could keep the water out. Then came the task of splitting the tube and cutting away the brass off the shaft. After six days of hard toil in the shaft chamber, where we had scarcely elbow room and where we always worked constantly saturated with water, the engineers cleared off the last piece of brass from the shaft and pronounced it ready for the coupling. You must know that our work all this time was extremely dangerous. The chamber in which we were had to be kept fully on the pumps the whole time to keep the water down, and if they had got choked there was only one manhole for the men to scramble out of. As soon as the shaft was ready the coupling, in three parts, each of which weighed 10 cwt., was lowered down with great care, and it was fitted on to the broken end of the shaft. This occupied another three days, and was, you may be sure, a time of much anxiety to us. On the 7th June we sighted the *Verajean.* At the time it was comparatively calm, but before she could speak to us it came on a howling gale again, so her captain could not board us. We were still working on the temporary shaft coupling, and on the 11th June, after 14 days of hard work, which had lasted right through the 24 hours, the first few turns of the propeller were taken You can imagine our feelings of joy and excitement when we once more heard the throb of the engines, which had been silent for six weeks or more. The temporary structure worked all right, and we got steerage way on the boat, and it was not a moment too soon. At that time we were within 46 miles of the rock-bound coast of Norfolk Island, and we were driving straight towards it at two or three knots per hour. It was not more than a day's drift from us. What made our drift so fast was the heavy gale that was raging, and it was accompanied with a mountainous sea. If it had not been for the repaired shaft we would have been absolutely helpless. That day we went slowly ahead with the engines all day, stopping them two or three times to adjust the couplings. So easy did we go ahead, for we were afraid to take too much out of her for fear the coupling would split off, that we did not make more than two or three knots an hour, but those two or three knots were in a direction to take us clear of the island. The next day the engines still continued revolving, and we steamed 83 miles to the westward. This distance was accomplished in spite of several stoppages which were made to inspect the broken shaft, and further adjust the couplings. At 3 a.m. on the 13th June we sighted the steamer *Talune.* She stood by us till daylight, when a hawser was passed aboard and we proceeded along towards Sydney. Here I cannot do better than tell you of the masterly manner in which Captain C. Spinks, of the *Talune*, managed his vessel. He brought her alongside the *Perthshire* as if she had been a little tug-boat instead of an inter-colonial trader. Our position when picked up by the *Talune* was latitude 29 degrees 14 minutes S., and longitude 167 degrees 6 minutes E. Now although we were under steam, and were getting two or three knots an hour out of the vessel, with the possibility of getting more, we were bound to take the offer of the *Talune*, because we did not know the moment the shaft might go again. We had, too, to consider the length of time that we had been out, and the fact that our passengers were women and children. The only other instance of cutting away a stern tube in the annals of shipping is that of *Tokio Maru.* But she was in the regular course of many lines of steamers, and so could make her own terms. We, on the other hand, if we had refused the tow of the *Talune*, might have broken down the following day, and there would be very little chance of us falling in with another steamer, at least so it seemed at that time, for the *Talune* would naturally have reported speaking us under "easy steam," and so no further search would be made for us. Our provisions were getting very low. We had plenty of meat aboard without broaching the cargo, for we had home stock in the freezing chamber, but our coffee and bread and vegetables had for some time been exhausted. After we had been in tow for two days, that is to say, on June 15th, at 9 a.m., we parted the hawser, and it was seven hours before we got fast again. A heavy sea was running, so we could not have the *Talune* alongside of us, but eventually we got a line on her by means of rockets, and then heavier lines were hauled from one to the other. This time the towing-line consisted of the anchor chains of each steamer with 60 fathoms of wire chain between them. Then we made the Australian coast without further mishap. Our steaming assisted the *Talune* considerably. It kept steering way on the *Perthshire* and was also of assistance in making headway. If we had been helpless it would have been three or four days longer. Off Newcastle our coupling began to slip considerably, and we stopped for the purpose of fixing it up again. The pumps were set going once more to clear out the shaft chamber, and the engineers got to work. This was done; but not till one of the engineers had gone below water and driven some wedges into the steam bush. We then resumed the voyage to Sydney under very easy steam, so as not to reach here till daylight. We entered the heads at 7.5 o'clock, and brought up off Robertson Point shortly after eight oclock.

Atmospheric Silent Ash Hoist.—We hear on very good authority that the Crompton Atmospheric Silent Ash Hoist is making progress, and steadily pushing its way with shipowners. We understand that over 800,000 tons of shipping of all classes are now using this simple and effective apparatus, and from entirely independent sources we hear of the satisfaction they are giving. We believe last month's crop of orders amount to 22 vessels to fit, nearly half of which emanate from one of the largest of the Continental mail companies who have previously proved their value in several of their steamers. Most of the leading British and foreign shipping companies are now adopting this invention for their steamers, as its previous record for absolute safety, effectiveness, and non-liability to breakdowns stands without a rival or competitor. The hoists are also being extensively used for land and stationary work, electric lighting stations, gasworks, factories, &c., where ashes and refuse from boilers are below the ground levels.

Messrs. Alldays and Onions.—We have just received an illustrated catalogue of improved fans, manufactured by Messrs. Alldays & Onions, of the Great Western Works, Birmingham, and Sherborne Lane, London. The catalogue is well illustrated, diagrams being given of the different classes of fans made, whether for workshop application or ventilation, or forced draught on board ship. Each type has a very concise and useful table, giving the various dimensions, tables of speeds, capacity in cubic feet per minute, and pressure in inches of water; and charts are included showing the different relative positions of base and inlet and outlet passages. The types particularly applicable to marine work are fully dealt with

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Amiralty, from August 26th to September 25th, 1899:—

Adams, W. H., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Andrew, G. E., engineer to the *Resolution*, to date August 28th.

Apps, W. R., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Aston, S., staff engineer to the *Pembroke*, for the *Ajax*, to date August 28th.

Barr, E., engineer in lieu of chief engineer to the *Revenge*, for the *Boxer*, undated.

Brown, H. A. (probationary), assistant engineer to the *Arrogant*, for training, to date August 31st.

Brown, W. J., fleet engineer to the *Pembroke*, for the *Irresistible*, to date August 28th.

Campbell, C. J. R. (probationary) assistant engineer, to be lent to R.N. College, for course of study, to date October 1st.

Clayton, F. A. (probationary), assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Clegg, H. J., engineer to the *Duke of Wellington*, for the *Ranger*, to date September 11th.

Cole, E. (probationary), assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Crabtree, E., engineer to the *Vivid*, for Keyham College, to date August 28th.

Cummings, G. R. T., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet on the retired list.

Curgenven, L. W. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Davis, H., assistant engineer to the *Vivid*, supernumerary, to date September 1st.

Davis, H., assistant engineer to the *Vivid*, for charge of reserve stores, and engineer of torpedo-boats, &c., to date October 5th.

Davis, W. H., inspector of machinery to the *Royal Arthur*, to date September 24th.

Dawson, T. J., acting engineer to the *Rupert*, to date August 28th.

Denbow, W., engineer to the *Icarus*, to date August 31st.

Eckford, P. G., to be assistant engineer R.N.R.

Edmonds, G. L. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Edwards, W., engineer in lieu of chief engineer to the *Hood*, for the *Bruiser*, undated.

Ellis, J. H. W. Howard, staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Everitt, A. E., assistant engineer, to be engineer in her Majesty's fleet.

Ewart, A. E., assistant engineer, to be lent to R. N. College for course of study, to date October 1st.

Ford, H. L. M., assistant engineer to the *Pelorus* (temporary), to date August 28th.

Gallery, E., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Glen, J. M., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Graham, J. E. D., fleet engineer to the *Pembroke*, for the *Imperieuse*, to date September 7th.

Haddy, F. C., assistant engineer to the *Hermes*, to date October 5th.

Haggarty, G. A., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet,

Hall, C. R., engineer to the *Duke of Wellington* (supernumerary) to date August 14th.

Hamilton, J. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Hammond, H. T., fleet engineer to the *Duke of Wellington*, for the *Pallas*, to date September 7th.

Harding, C. A., staff enginer to the *Hermes*, to date October 5th.

Head, E. A. William, engineer has been promoted to the rank of chief engineer in her Majesty's fleet.

Highton, F. W., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Hobbs, L. M., assistant engineer to be lent to R.N. College for course of study, to date October 1st.

Hocken, J. H. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Howlett, W. A., fleet engineer to the *Pembroke*, for the *Grafton*, undated.

Hughes, J., (probationary) assistant engineer to the *Furious*, for training, to date August 31st.

Hyde, T. H., fleet engineer to the *Duke of Wellington*, for the *Hercules*, to date September 7th.

Jackson, L., assistant engineer to the *Vivid*, for the *Magpie*, to date September 18th.

Kimber, J. L., engineer to the *Wildfire*, for the *Reserve*, to date September 8th.

Lawrence, W. G., engineer to the *Widgeon*, undated.

Lawton, W. R., engineer to the *Tamar*, for charge of machinery of torpedo-boats, to date September 11th.

Lester, A. E. (probationary) assistant engineer to the *Niobe*, for training, to date August 31st.

Macnicoll, A. D., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Mann, W. S. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Manning, H L., chief engineer to the *Pembroke*, for the *Scylla*, to date August 28th.

Martin, G. R. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st..

McKinlay, A. W. (probationary) assistant engineer to the *Furious*, to date August 28th.

Michell, W. H. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Nicholson, J. B. (probationary) assistant engineer to the *Pelorus*, for training, to date August 31st.

O'Dougherty, H. B. O. (probationary) assistant engineer to the *Pactolus*, for training, to date August 31st.

Paris, W. de, engineer to the *Pembroke*, for the *Audacious*, to date August 28th.

Parnall, W. R., assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Perkins, G. L. Roberts, chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Phillips, R., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Read, H. C. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Reynolds, T. R., chief engineer to the *Barham*, to date October 3rd.

Riley, J. S., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Robins, L. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Ryan, J., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Sands, J., assistant engineer to the *Ramillies*, to date August 26th.

Sadler, T., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Scott, E. B. (probationary) assistant engineer to the *Diadem*, for training, to date August 31st.

Shea, E. S., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Shirvell, J., fleet engineer to the *Vivid*, for the *Highflyer*, to date September 8th.

Stuart, M., chief engineer. has been advanced to the rank of staff engineer in her Majesty's fleet.

Talbot, J. C. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

Thorne, C. W. fleet engineer to the *Vivid*, for the *Pique*, to date September 7th.

Vibert, J. E., engineer in lieu of chief engineer to the *Royal Oak*, for the *Dragon*, undated.

Watson, L. J., engineer to the *Pembroke*, for the *Goliath*, to date September 7th.

Westmoreland, F. G., engineer R.N.R. to the *Duke of Wellington*, for instructional course, to date October 3rd.

Wheater, P., engineer to the *Barfleur*, for the *Fame*, in lieu of a chief engineer, to date September 8th.

Wheatley, T. E., to be assistant engineer R.N.R.

Whebby, T., fleet engineer to the *Cleopatra*, to date September 7th.

Wilson, J. D., engineer to the *Hermes*, to date October 5th.

Wood, A. O., assistant engineer to the *Majestic*, to date October 5th.

Wyles, E. (probationary) assistant engineer, to be lent to R.N. College for course of study, to date October 1st.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

DURING the month of September, or as much of it as has passed at the date of writing, 23rd ult., exceptional activity has prevailed throughout the yards and engine shops of the Clyde and other Scottish districts. Measured by the output of new shipping, indeed, the month has proved—or gives every promise of proving - a record period. All told, about 55,000 tons have been added to the world's mercantile fleet; and should, as is expected, the Allan Line twin-screw steamer *Tunisian* be sent off the stocks, by Messrs. Alex. Stephen & Sons, of Linthouse, another 10,000 tons will fall to be added to the aggregate. There is just a chance, however, that the send-off of this important vessel may be postponed until early in the present month.

Launches, more than is usually the case, occurred in batches, or lots, as large an output as 17,500 tons being recorded in two separate days. In point of size the largest vessel was the *Ranee*, 8,200 tons deadweight, launched by Messrs. Charles Connell & Co., Whiteinch, for the Asiatic Steam Navigation Co., Liverpool, followed closely by the *Urlana* of 8,000 tons, by Messrs. A. & J. Inglis, Pointhouse, she being the second of four steamers at present under construction by the same firm for the British India Steam Navigation Co.

As to fresh contracts, there has been a continuation of the flow of important orders which began to set in about two months ago, and notwithstanding the large output, there is no apparent diminution of new keels. Altogether some 30,000 tons of fresh shipping have been ordered, only a small proportion of which is naval work. It is, moreover, pretty certain that a number of owners have specifications ready to place before builders immediately the price of materials shows signs of breaking, it being stated that as many as 15 or 16 steamers, most of them of large size, are definitely in prospect on that contingency.

The Fairfield Shipbuilding and Engineering Co., Limited, Govan, have during the month been entrusted by our Admiralty with an order for two additional torpedo-boat destroyers of 30 knots speed, to be named the *Falcon* and *Ostrich* respectively; and the same company have been commissioned by the Indian Government to build and engine a large and fast twin-screw troopship to be delivered next year The vessel is to be 420 ft. long, 51 ft. beam, and 31 ft. deep, and is to steam 18 knots on a six hours' run at the loaded draught. Sir E. J. Reed, K.C.B., &c., is the naval architect and engineer. The Fairfield Co. are progressing satisfactorily with the Government contracts they have at present on hand—these comprising two first-class cruisers *Cressy* and *Aboukir*, of 12,000 tons displacement; the mighty armoured cruiser *Africa*, of 14,500 tons, 30,000 I.H.P., and 23 knots speed, ordered in January last; the 9,800-ton cruiser, *Bedford*, ordered in May last; and two 30-knot torpedo-boat destroyers, the latter of which are now wholly in frame.

Messrs. Robert Napier & Sons, Limited, Govan, launched on the 20th ult. the *Trent*, the second of two steel-screw steamers which they have on hand for the Royal Mail Steam Packet Co., London. Specially designed to suit the requirements of the company's West India mail service, the dimensions are:—425 ft. length; 50 ft. breadth; 35 ft. depth; gross tonnage about 5,500. The earlier vessel, the *Tagus*, has coaled, and will shortly leave the Clyde for London.

The London and Glasgow Shipbuilding and Engineering Co., Limited, having recently handed over to the Admiralty, after satisfactory trials, the gunboats *Thistle* and *Dwarf*, are now busily occupied on the 9,800-ton cruiser of the modified *Cressy* class, the order for which was received at the same time that the Fairfield Co.—above noticed—received theirs for a similar vessel. As no other Admiralty work is at present on the stocks of the London and Glasgow Co., this vessel, which is to be named the *Monmouth*, should rapidly assume shape, although the delay in obtaining material is, in this as in other similar cases, a serious drawback. In the river, opposite the yard, the second-class cruiser *Hyacinth*, 5,600 tons, still lies undergoing outfit, though to all appearances nearing thorough completion.

Messrs. D. & W. Henderson, Meadowside Yard, Partick, who have already built so many of the Anchor Liners, have received instructions to proceed at once with the construction of two steamers of about 6,000 tons each for the Atlantic branch of the well-known Anchor Line fleet

Messrs. John Brown & Co., Limited, Clydebank Shipbuilding and Engineering Works, is now the officially announced title by which the Clydebank concern must in future be known, although, doubtless, long habit, use, and wont, and perhaps a touch of regret and sentiment, may as often as not cause the title "Clydebank Shipbuilding Co.," or the still older and more popular "Thomson's Shipyard" to be used. A circular dated September 1st was issued by Mr. A. McMillan, secretary of the Clydebank Engineering and Shipbuilding Co., Limited, in which it was stated: "We beg to inform you that the negotiations for the purchase of the business of this company by Messrs. John Brown & Co., Limited, are now completed, and that company take possession of the works to-day. The business will in future be carried on under the name of John Brown & Co., Limited, and it is requested that all communications respecting the shipbuilding and engineering business at the Clydebank Shipyard be addressed to that company at Clydebank." In connection with the purchase of this renowned yard by the Sheffield firm. a rumour, which one can only stigmatise as silly, was set about to the effect that in consequence of the purchase Messrs. John Brown & Co. intended to transfer the manufacture of armour from Sheffield to their newly acquired works. This rumour the great Sheffield firm has taken the trouble to semi-officially deny. The plant at Sheffield represents more than half a million of capital, and over £200,000 have been spent comparatively recently in adapting it for the new Krupp process.

Messrs. William Denny & Brothers, Dumbarton, who have been credited during the month with having received an important order from the Russian Volunteer Fleet for a twin-screw steamer of dimensions, speed, and accommodation similar to vessels previously built for the same owners, contradict in a local paper that this is the case; and they also deny that they have been entrusted, as previously reported, with the order for a repeat of the twin-screw *Bavarian* quite recently handed over to the Allan Line. It would appear however, that this firm have, in common with Messrs. R. W. Hawthorn, Leslie & Co., of Hebburn-on-Tyne, received the order for a twin-screw steamer of about 8,000 tons gross register for the New Zealand Shipping Co., Limited, London. The vessels are to be 457 ft. long, 58 ft. beam, and are to steam 12 knots at sea. Like the *Paparoa* presently being completed for the same company by Messrs. Denny, they are intended for the frozen-meat trade between New Zealand and the home country, and, besides carrying a limited number of first and second-class passengers, will have accommodation for considerably over 100,000 carcases in their cold chambers. They are to be built to the scantlings, and under the special survey, of the British Corporation registry, and are to be ready for delivery in the autumn of next year.

Amongst the other work at present under way in the large shipyard of Messrs. Denny & Brothers is the magnificent twin-screw steam yacht of high speed and great splendour of internal fitment, ordered some time ago by Mr. Bennett, proprietor of the *New York Herald*, through the noted Glasgow designers, Messrs G. L. Watson & Co. There is also in course of construction, to be ready for next season's trade, a paddle-passenger steamer for the Belle Steamers and Coast Development Co., London. This vessel, which is to be named *Southwold Belle*, will in appointments and speed be one of the finest passengers steamers yet built for this company's coasting service.

Messrs. William Hamilton & Co., shipbuilders, Port-Glasgow, have received an order from Continental owners for the construction of two steamers of about 7,000 tons deadweight capacity, the engines for which are to be supplied by a Glasgow firm.

Messrs. Carmichael, McLean & Co., shipbuilders, Greenock, who began business four years ago—the two partners Mr. John Carmichael and Mr. A. McLean, having both been connected with the Fairfield Co.—and who have turned out a considerable number of important vessels during the period, have been under the necessity of signing a trust deed in favour of Mr. Patrick Rattray, accountant, Glasgow, with an advisory committee of the firm's principal creditors. Messrs. Rattray Brothers & Co., Glasgow, have stated in a circular addressed to the creditors that their firm was requested by some of the creditors to ascertain the position of the firm. There is a cor amount of work on hand, or on order from the firm, and the eventual out-turn is almost wholly dependent on the completion of these contracts. Some arrangement as to subletting the yard and work on hand may shortly be entered into; but meantime the yard is closed. The stoppage was intimated by a notice posted on the yard gates when the workmen turned out as usual at six o'clock on the morning of the 21st ult. The notice stated: "These works are now closed until further notice. Wages will be paid to night (Thursday) at five o'clock." Several hundreds of workmen have thus been thrown idle, but most of them are hopeful that work on the unfinished vessels will be resumed shortly. (Since above was written the notice in question has been taken down, and work resumed.)

An advance in their wages is now being agitated for by the blast furnacemen in Scotland, although since January of this year they have had their wages advanced 35 per cent. Notwithstanding this substantial increase, the men seem to think that they are still underpaid as compared with their fellows in the North of England. They assert that, although twelve-hour shifts are wrought in Scotland—as against eight-hour shifts in the South—less money is actually earned by the men in the North. Accordingly on the 20th ult. the Amalgamated Society of Steel and Iron Workers sent out circulars to all the owners of blast-furnaces in Scotland demanding an advance of 10 per cent. on the existing rates of wages. The Scottish pig-iron industry has this year had, without doubt, a spell of almost unparalleled prosperity, but there is a growing opinion in the trade that this condition of affairs will not much longer obtain. Masters have indeed recently been accepting prices for crude iron which even a few weeks ago they would not have looked at. Under these circumstances it is not likely that the masters will accede to the present demand unless compulsion in some form is resorted to. Unfortunately there is no conciliation board for this particular branch of the iron and steel trade, so that prolonged negotiations will likely ensue before a settlement is effected.

In the September report of the Clyde District Committee of the Boilermakers and Iron and Steel Shipbuilders' Society, several points of special interest to employers and workers alike are touched upon. The report states that "the use of pneumatic caulking machines is becoming very prevalent, and the vibration therefrom entails hard, laborious labour on the operator, for which he ought to be recompensed over and above the ordinary rates. If the firms who have such machines in use are approached in a rational manner, we have no doubt that the claim of our members will be recognised." The scarcity of rivet-heaters is a problem that will have to be solved sooner or later. There is no inlet for such a class nowadays; at one time the ranks were filled from blower boys, but these have been abolished. As a rule rivet-heaters become apprentice riveters, and, as matters are at present, when such a change takes place the squads of riveters are thrown idle. It would be beneficial to employers and employees alike if some scheme could be adopted whereby learners could be introduced.

Messrs. W. C. Martin & Co., electrical engineers, Glasgow, have secured the contract to fit the large Cunard liner *Invernia*, launched from the shipyard of Messrs. Swan & Hunter, Limited, Wallsend-on-Tyne, on the 21st ult., with electrical plant for lighting and power. The electric lighting of the vessel is to be on a very extensive scale, the plant consisting of two compound engines coupled direct to two dynamos, each set capable of supplying current to light 1,500 eight-candle-power lamps. A powerful search light giving 20,000 candle-power is to be fitted at the bow of the steamer for navigating purposes, and a thorough system of heating and ventilating all the rooms, machinery, and cargo spaces will be installed. Ten 3-brake H.P. electric motors, and ten 30-in. fans driven direct will be fitted, five of the fans to drive cold air through Stewart's patent thermo tanks heated by steam, when the air will be heated to a certain temperature, and then carried into each room by ventilating trunks. The other five fans will exhaust the foul air from the holds at the rate of 12,000 cubic ft. per minute. Electric motors will also be used for driving the hair brushes in the barber's shop, and for other purposes.

The Stewart system of thermo-tank ventilation above referred to is intended to obviate as far as possible the various objections to the ordinary system of steam heating generally in use on board ship, and it has been already adopted in a number of large passenger-carrying steamers, notably in two built for the Russian Volunteer Fleet by the Clydebank Shipbuilding Co. The system combines an efficient ventilating system with an improved arrangement of heating. An efficient form of heater is combined with a steam or electrically driven fan, and placed on deck or outside the compartments to be heated and ventilated. This heater is connected to the ventilating trunk through the compartments and rooms and any required volume of air at any required temperature can be delivered to the compartments. By a suitable arrangement of valves on the connections to and from the thermo-tank, air may be exhausted from the compartments to the atmosphere; or may be circulated in the compartments through the heater, thereby raising the temperature very rapidly; and it may also be delivered direct into the ventilating trunks without passing through the heater. In a future issue a fuller description of the system, with details of the construction and arrangement of heater, valves, trunkways, &c., will be given; but, as indicating the great efficiency of the system as compared with ordinary steam-heating by pipes, one result may be stated of comparative trials made by the officers of the Russian Volunteer Fleet on two steamers belonging to that fleet. The steam supply pipe was the same size in both cases, but whereas in the ordinary pipe heating system the stop-valve was full open, in the case of the thermo tank it was only one turn open; so that, in addition to a greatly increased heating power, there is a large saving in steam consumed.

Messrs. Hawthorn & Co., Limited, shipbuilders and engineers of Leith and Granton, have contracted to build a steam yacht of 650 tons and 200 ft. in length, to the order of his Imperial Highness the Archduke Charles of Austria. She is to be constructed of steel to Lloyd's highest class, and from the designs and under the superintendence of Mr. Alfred H. Brown, of London.

Messrs. Ramage & Ferguson, shipbuilders and engineers, Leith, have received the order for a steel steam yacht of 100 tons, yacht measurement, and 100 ft. length, from Messrs. Cox & King, London, the owner being Mr. Thomas L. Aveling, of Rochester. The vessel will be fitted with triple-expansion enegines to develop 280 I.H.P. In my last month's notes it may be recollected intimation was made of the fact that Messrs. Ramage & Ferguson had received the order for an 800 ton twin-screw steam yacht for Mr. Harry McCalmont, M.P. Although, as from this it is apparent, and as is well known, Messrs. Ramage & Ferguson make a speciality of steam-yacht building, the firm is frequently requisitioned for the production of large merchant ships. Not very long ago they sent off the stocks the largest vessel ever produced in Leith, and now they have received an order for a still larger vessel—a steamer of about 6,000 tons deadweight from Messrs. William Thomson & Co., Leith, intended for that company's Eastern trade.

Messrs. Andrew Campbell & Co., Springfield Quay, Glasgow, have secured the contract to construct a new hauling-up slip on the shores of Loch Katrine, to be used for the reconstruction and launching of the new steamer *Rob Roy*, now being built at Dumbarton. The slip, which is to be about 350 ft. long, with gangways, cradle, winch, and other necessary gear, will afterwards be used for cleansing and repairing purposes connected with the *Rob Roy* and other boats plying in the loch. The slip is to cost £1,500, and is to be laid down under an agreement between the Duke of Montrose and neighbouring proprietors and the Corporation of Glasgow; Loch Katrine, of course, as is well known, being the vast repository from which the city of Glasgow draws its magnificent supply of water. It is worthy of note that the new *Rob Roy* will be fitted with a water-tube boiler of the type being introduced by the well-known firm of Messrs. G. & J. Weir, of Cathcart.

The Prince's Dock, Glasgow, is now almost wholly equipped with double warehouse sheds around the several basins, and provided with railway lines, &c., along its extensive quays For some time past a pile foundation for the rails on which the massive steam coaling crane along the south quay of the southmost basin is propelled has been under way, and when this work is completed the scope of the crane for coaling purposes will be greatly increased. The railways lyes are being extended at the same time, and, when the improved outside communication is opened up, this will become one of the most useful parts of Glasgow Harbour. It is expected that the scheme for electrically lighting the whole harbour will be completed during the present month. Most of the small cranes in the Prince's and Kingston Docks will be wrought by electric power.

The burgh of Renfrew is naturally quite well pleased with itself and its staunch friends over the success attained in Parliament with the Burgh and Harbour Extension Bill, which is now, of course, an Act. Provost Andrew Brown (of Messrs. William Simons & Co.), in submitting the Parliamentary Committee's report on the securing of the Act—which, of course, means the breaking down of the monopoly of the Clyde Trust in providing docks on the river—indulged in no unnecessary jubilation; although a little of this would only have been natural, nor yet in any overstrained forecasting of the future in store for the burgh when the new dock, and the new condition of things thereby brought about, will have become accomplished facts. That the direct communication which will in due time be established between the burgh and the three great Scottish railway systems, and consequently with all parts of the kingdom, will, as Mr. Brown declared, "work a great revolution in the history and fortunes of Renfrew" is undoubted; but Mr. Brown must sufficiently realise that, even when the new dock has been fully constructed and equipped as a going concern, Renfrew must look for something like a struggle before it can secure trade for it sufficient to do more than make ends meet, especially on the assumption that the Clyde Trust are as determined to proceed with the dock for which they have obtained powers at Yoker on the north bank of the Clyde as the Renfrew promoters are to go ahead with theirs on the south bank. Provost Brown clearly announced that "no time will be lost in making necessary arrangements for proceeding with the harbour extension and the new dock." This is as it should be. The burgh has committed itself to a big scheme, and success will depend largely on early and vigorous application to the task taken in hand.

The new graving dock for Leith, which the dock commissioners had at first intended to lay down at the east, or far, end of the new wet dock, now in progress, and within measureable distance of being completed, will now be constructed at the west, or harbour, end of that dock, a situation which should better suit ship repairers at least. The length of the graving dock is to be 500 ft., and it has also been resolved by the Works Committee to increase the length of the wet dock now under way from 750 ft., as hitherto arranged, to 800 ft. The larger sizes have naturally commended themselves to shipowners and shippers, those of them at least having to do with ships in oversea as distinguished from mere coasting or cross-channel vessels.

Aberdeen will shortly be provided with a pontoon dock, intended mostly for the docking of trawlers and other small vessels up to 430 tons. This pontoon dock, which is being constructed on the Thames by Messrs. Clark, Stanfield & Co., at their building premises at Tilbury, is of the L shaped or offshore design, on to which a vessel may be floated either from the ends or broadside. It is 126 ft. long by 37 ft. width, and the pumping and other apparatus will be worked by electricity, and eight powerful arc lamps provided, all supplied with current from the corporation mains. The total cost will be somewhat over £8,000.

Amongst the recent winners of Whitworth scholarships is Mr. W. W. Shearer, Glasgow, who secures £125 a year for three years. There are only four of this value, the others having gone to students in London, Bradford, and Oldham.

THE TYNE.

(From our own Correspondent.)

Shipbuilding.—Since last month a limited number of orders for vessels of a special class have been booked by builders on the Tyne, and a good proportion of the Admiralty work lately given out has also found its way to this district. Messrs. Hawthorn, Leslie & Co. have secured orders in both the mercantile and warship lines, amongst the former being a boat of over 8,000 tons carrying capacity, to be employed in the New Zealand meat trade, and two of an almost equal capacity that are intended for the South African service. The first-mentioned vessel is to have duplicate engines, and will, we understand, be the first steamer engaged in the colonial meat carrying service, to receive such an equipment. The experiment is undoubtedly an expensive one, but in view of the continually recurring accidents to tail shafts, which in single-screw vessels are usually of such fatal import, there can scarcely be a doubt that it will pay. The probability is, indeed, that for meat ships and other vessels of a more than ordinarily valuable class, duplicate engines will become the fashion ere long, and that before many years are past every vessel above the rank of a common tramp steamer will be provided with two sets of engines. This arrangement will give them a practical immunity from such accidents as those mentioned above (it would be strange, indeed, if both engines failed simultaneously), not to speak of the possibilities in the direction of higher speeds. The Admiralty work secured by the firm consists of some torpedo-boat destroyers, and a vessel of a more important class; and, taking all things into account, there is reason to believe that this firm are provided with enough work to keep the machinery fully going over the whole of next year. We understand that the firm have adopted the system of "joggle" plating introduced by Messrs. W. Doxford & Sons some four years ago, and which has since been adopted by Messrs. Armstrong, Whitworth & Co., Sir James Laing, Messrs. J. L. Thompson & Sons, and other firms of importance. The purpose of "joggle" plating is to dispense with "packing" between the frames or angles, and the plating, and this is achieved by "joggling" the overlapping edges of "outside" strakes, so as to admit of the whole area of the plating being brought into contact with the structure, leaving no apertures between the "outside" plates and the framing, and consequently rendering "packing" unnecessary. The advantages of the system are obvious, and difficult, as it apparently is, to break through the immobility of many shipowners and shipbuilders in anything involving a departure from old methods, there is not the least reason to doubt that this system will eventually force its way into general adoption.

The Palmer Co. have also secured a share of the Government work, and have besides been commissioned to build two exceptionally large vessels for Messrs. Elder, Dempster & Co. The company's Howden yard is not likely to be again used for shipbuilding purposes, and in confirmation of this view it may be stated that the scaffolding uprights have been taken down, and the greater part, if not all, of the machinery has been removed. The site is an excellent one, however, and is certain to be utilised for the purposes of some other industry before long.

The Tyne Shipbuilding Co. have three vessels in the plating, framing, and keel-laying stages, and one in the river fitting out; and the Northumberland Shipbuilding Co. have four vessels in various stages of progress, and are about to commence the construction of another. The company have recently disposed of a vessel, now in an advanced state of construction, to Messrs. H. Evans & Co., of Liverpool. The vessel, which will be launched very shortly, is 350 ft. long, and has a carrying capacity of 6,500 tons.

Messrs. Wood, Skinner & Co., of the Bill Quay Yard, have four good-sized vessels on the stocks, and are understood to have secured a good order for trawlers. The firm have, at all events, invited tenders for a number of trawler engines, to be delivered, as the ships become ready. Messrs. Dobson & Co. have one or two large vessels in hand, and also some small steamers of a special type. They have also one or two vessels in the river receiving their machinery equipments.

Messrs. R. Stephenson & Co. have received instructions from the Spanish Government to proceed with the construction of the pontoon dock, ordered some three or four years ago, but the work of which had been discontinued during the progress of the war between Spain and the United States. The pontoon was originally intended to be located at a port in the Philippines, but owing to the changes that have taken place a different destination will now have to be found for it. The work of completing the pontoon is now in active progress, and will afford employment to a large staff of hands for several weeks to come. The large cattle ship *Montauk Point* having been launched early in the month, there now remains but one vessel on the stocks, this being the second of two steamers of moderate size, ordered last year by the United Steamship Co., of Copenhagen. It is considered probable that the company will not trouble much about securing any further work in shipbuilding until the changes contemplated have been fully carried out.

Messrs. C. S. Swan & Hunter have booked an order for a large vessel to be added to the Harrison Line, Liverpool. The vessel is of the same design as the s.s. *Politician*, built for the same line a couple of years ago, and will be similarly equipped. There are rumours of other orders having been secured, but of these we cannot speak definitely.

An event referred to in our Notes last month has come to pass, namely the launching of a Cunard liner from one of the covered berths at this firm's yard. This is, without doubt, the largest vessel ever built on the Tyne, and is perhaps, also the most remarkable. We have had telegraph ships, oil ships, and warships; and we have had ice-breaking steamers such as the world had never seen, and the performances of which in clearing icebound waterways, and releasing vessels, are simply marvellous; but never before has there been produced on the Tyne an

Atlantic passenger steamer of the first-class, which will not, we confidently believe, suffer in comparison with the best productions of the Clyde or Belfast. The launching of this vessel is therefore an event of the rarest interest, and marks a big forward step in the shipbuilding capacity of the district. The launch, which was in every respect successful, was witnessed by a large concourse of people, and amongst the invited visitors were many gentlemen of note in shipbuilding and commercial circles. Congratulatory speeches were delivered at the luncheon, which was provided for the guests immediately after the launch, and the function as a whole was one to be remembered by all who had the good fortune to take part in it.

Messrs. Armstrong, Whitworth, & Co. have launched an oil-carrying steamer from their Low Walker yard, and a Japanese cruiser from their Elswick establishment during the month. They have still several berths occupied at the latter yard, and others in the water fitting out, whilst at Low Walker all the available building space is occupied, some of the vessels in hand being of special importance and exceptionally large dimensions. Messrs. Wigham, Richardson & Co. have laid the keels for a couple of vessels lately, and have now five on the stocks. They have also several vessels being fitted out or repaired in the river. Repair contracts are pretty numerous just now, and all the graving docks and slipways are occupied.

Engineering.—Within the past couple of weeks an increase of inquiries has been noticeable, especially for machinery intended for the equipment of superior vessels. Some contracts have also been placed, amongst them being the engines for a large steamer to be built at Messrs. C. S. Swan & Hunter's, and the propelling machinery for three very costly dredgers, to be built by Messrs. Armstrong, Whitworth & Co. The engine works connected with Messrs. Palmer and with Messrs. Hawthorn, Leslie & Co. have, of course, been reinforced with the machinery contracts in connection with the vessels booked respectively for their shipyards.

The North Eastern Marine Engineering Co. have a large amount of work in hand, including the machinery for two vessels building by Messrs. Craggs, of Middlesbrough, for the Adria Co., of Fiume. It may be here noted that a number of vessels built at Middlesbrough have been engined on the Tyne lately. Amongst these may be mentioned the s.s. *Philippeville*, built by Sir Raylton Dixon to the order of Messrs. Elder, Dempster & Co., and intended to run as a mail and passenger steamer between Antwerp and the Congo. The vessel has twin-screw engines of large power and four single-ended boilers to work at a pressure of 180 lbs. On coming from Middlesbrough to the Tyne the vessel met with a slight accident to one of her propellers, which necessitated dry-docking for a brief period.

The torpedo-boat destroyer *Viper* is now beside Messrs. Parsons's new yard at Wallsend receiving her equipment of Parsons's steam turbine machinery. Excepting the experimental boat *Turbinia*, this, we believe, is the first vessel that has been fitted with machinery at the works. There is some talk of a large vessel being built with a view to giving further scope for ascertaining the capabilities of the turbine engines, but it will doubtless depend upon the results obtained from the *Viper* machinery whether the project mentioned is carried out or not.

Messrs. R. Stephenson & Co. are now engining at Newcastle Quay a large vessel recently launched from their Hebburn Yard. The engines are of large power, and the boilers are fitted with Howden's forced draught. These boilers, as also a large marine type accessory boiler (for the deck machinery), are constructed to work at 180 lbs. pressure. There is a probability that Messrs. Stephenson will erect marine engine shops in contiguity to their yard at Hebburn, so as to minimise to the greatest possible extent the difficulty of putting heavy machinery on board ships.

The Combination Metallic Packing Co., of Hillgate, Gateshead, and Lombard Street, Newcastle, have largely increased their sales this year, and are now so busy in fulfilling urgent orders that a resort to nightly overtime in the workshops is found necessary. The popularity of the packing is evidently on the increase, or this exceptional and long continued briskness would not exist

The works of Messrs. H. Watson & Sons, Walker Gate, are extremely busy, orders for the firm's various specialities for steamship service being plentiful.

At Messrs. Clark, Chapman & Co.'s works business is also good, and the production of deck accessories quite up to the average of recent months. In the electrical departments work is plentiful, and the boiler shops are as busy as possible. Messrs. Emerson, Walker & Thompson Brothers are having their full share of business, and both their forging and iron-founding departments are running full time. The smiths' shops and also the fitting shops are extremely busy, and in some departments the working of a double shift is found necessary.

Messrs. Thomas Boydell & Co., manufacturers of ship and engine-room telegraphs, Prudhoe Street, Newcastle, are, like most other firms in the same line of business, just now very busy, amongst the contracts in hand being several for the equipment of ships building on the Tyne and Wear.

Mr. T. Beynon, of 9, Dean Street, Newcastle, has been appointed agent for the North-East Coast, of the "Dexine" Patent Packing Co., and Rubber Co., Limited, Stratford. The products of the companies are understood to have very special merits, and are said to be peculiarly applicable to marine engines. We hope to refer to them at greater length in a future number.

THE WEAR.

(*From our own Correspondent.*)

Shipbuilding.—In the Wearside yards business is still at high pressure, and is likely to be continued so, till (at least) the end of the year. We hear that Messrs. Doxford have been commissioned to build two more steamers (in addition to the six mentioned last month) for the owners of the "Clan" line, to whom they have already supplied some dozen vessels, many of them of very large capacity. They have all been "turret" ships, and the preference of the "Clan" owners for this type of vessel, is pretty decisively shown by the number of repeat orders given.

Messrs. J. L. Thompson & Sons are reported to have booked orders lately; but at present we are not in a position to say whether the report is correct or otherwise. The firm have their five berths filled, as usual, three of the vessels being in the framing and plating stages, and two only recently commenced. A very large new steamer is being fitted out at the firm's Manor Quay repairing works, and there are also some repair contracts in hand.

Sir James Laing & Sons are reported to have been commissioned to build two vessels for Messrs. Bucknall Bros, a firm for whom they have built many vessels in previous years. This firm—through extensions made within the last couple of years—have now seven building berths, all of which are, at the time of writing, occupied.

Messrs. Robert Thompson & Sons continue to have abundance of work for their Southwick yard, and are also pretty busy in their repairing department, at the Bridge Dock. There is at present an exceptionally important contract in progress at the last named establishment, this being the lengthening, by nearly 20 ft., of the Dutch steamer *Rijnstroom*. The fore part of the vessel was cut away immediately forward of the machinery compartment, and subsequently "launched" the required distance. The breach made is now being rapidly "built in," the new structure being, of course, exactly in harmony with the lines of the ship, so that when the connection is completed, there will be no deviation from the natural curve or "shear." The last contract of this kind carried out in the Bridge Dock, was the lengthening of the s.s. *Concrete*, belonging to the Wear Commissioners.

Messrs. Priestman & Co. launched early in the month a large cattle ship ordered by Hamburg owners, and have a duplicate ship well advanced towards completion. It is reported that the firm have a third ship of the same size and type to build; but of this we are not in a position to speak definitely.

Messrs. Blumer & Co. have their berths fully occupied, and the same may be said of the Sunderland Shipbuilding Co., and Messrs. Bartram & Sons. The latter firm have material being delivered for other vessels besides those on the stocks. Messrs. Austin are very busy in both new and repair work, and the Strand Shipbuilding Co. have also a full supply of work in both lines. The latter firm have received from the Wear Commissioners the contract to supply the "roundhead" required to complete the end of the new north pier. It may be here stated that some other items in the Wear Commissioners' programme of improvements are approaching completion, notably the new coal shipping staiths, where vessels of almost any tonnage can be brought alongside, and the new quay at the south side of the river. Other items of still greater importance have, however, yet to be commenced, including the addition of some four acres to the water area of the south dock, and the making of a new graving dock equal to the accommodation of any ship afloat. Many other improvements are contemplated, and when the whole programme is completed, the port of Sunderland will, as far as shipping facilities are concerned, be entitled to take rank as one of the first ports in the kingdom.

Engineering.—A slight diminution of activity was noticeable in some of the local engine works lately, and night shifts were either discontinued or the staffs reduced We do not think the temporary slackness arose from a want of orders, but was simply the result of the engineering work being slightly ahead of the ship work. This, it will be remembered, is the reverse condition to what existed towards the close of 1897. We understand that Messrs. MacColl & Pollock have received an order to supply the machinery for two vessels building at Middlesbrough. The firm have discontinued night work for a time.

Messrs. Wilcox Brothers have had a very marked success with their Radio Mundel evaporator, recently put upon the market. It has been fitted in a number of steamers, amongst which may be mentioned the s.s. *Queen Wilhelmina*, the *Olive Branch*, and the *Ohio*, and is now being fitted on another boat belonging to the owners of the last named. In every case where it has been fitted excellent results are reported, and these good reports are fully borne out by the number of repeat orders given.

Messrs. James Speeding & Co., Whickham Street, Monkwearmouth, are doing a large business as ship merchants and engineering furnishers, and have found it necessary to add to their premises a new warehouse of considerable extent. Since making this addition they are in a position to meet customers' requirements very promptly.

The Hartlepools.—At this centre the activity in shipbuilding is fully maintained, and its extent may be judged from the fact that Messrs. Gray & Co. launched three vessels of an aggregate carrying capacity of 14,000 tons in August.

Messrs. Furness, Withy & Co. have some very big work in hand, and at Messrs. Irvine's yard an array of full berths is to be seen .

In the engineering works business is still brisk, whilst at the steel works the machinery is kept running night and day.

Stockton.—Messrs. Ropner & Son launched on the 20th inst. a vessel of 5,500 tons capacity—ordered by Hartlepool owners, and have four others on the stocks of somewhat similar capacity. At the other yards there is also a plenitude of work in hand. Messrs. Blair & Co. continue to be exceedingly busy, and other firms engaged in the manufacture of ship accessories are having as much work as they can deal with.

Middlesbrough.—Sir Raylton Dixon & Co. are said to have secured some important orders, and at Messrs. Craggs's establishment briskness continues to exist. Boiler shops continue full of work, and foundries are still quite brisk. Steel works continue as active as ever, and engineering works of all kinds are participating in the general good trade.

Darlington.—The Darlington Forge Co. have a number of important contracts in hand, and their output this year has, so far, been unprecedentedly large.

THE MERSEY.

(*From our own Correspondent.*)

ALTHOUGH it can scarcely be said there is any actual falling away in the present activity at engineering works generally in this district, there are still unmistakable indications that the exceptional briskness that has prevailed since the commencement of the year has touched the maximum point. Reports from most branches of trade are now to the effect that, although the leading establishments have still sufficient orders on their books to keep them fully going into next year, there is an undoubted slackening off in the weight of new work coming forward, and in the majority of cases the contracts that are being completed are not being replaced by new work in equal quantity. No doubt the very considerable advance in prices during the past few months has had its effect in checking new undertakings that are not of any pressing need, and it is probable that a very large amount of work is simply "pigeon-holed" for the present, but will come forward eventually, either when it is evident prices are not likely to be lower or when there has been some substantial giving way upon the high quotations that just now have to be made for new orders that engineering firms are in a position to entertain. The recent indications of some revival in the shipbuilding trade of the North, however, tend to give a more encouraging outlook to this branch of industry on the Mersey, and for the present the yards on the Birkenhead side continue fully engaged on work in hand.

Referring more particularly to the various sections of engineering, it may be noted that the leading machine-tool makers continue well employed, with a fair amount of new work coming forward, but some of the general branches are not in so satisfactory a position. In the locomotive building trade there are signs of returning animation, and boiler makers report no diminution of activity, but stationary engine builders are scarcely so well off for orders, and in the textile machine-making trade there is a continued absence of new work going out sufficient to replace that which is being completed. Electrical engineers continue in a more than satisfactory position both as regards work in hand and coming forward.

The usual monthly returns of the leading trade unions show a continued low unemployed list, the general tendency being towards a further slight reduction in the number of out-of-work members on the books. The Amalgamated Society of Engineers has only 2,073 out of 84,293 members on donation benefit, representing less than 2½ per cent., whilst in this immediate district the proportion is about the same. In the Steam Engine Makers' Society there are now only about ¾ per cent of the total membership on benefit, and in the Lancashire branches practically a clear book is reported. The United Machine Workers' Association has about 2½ per cent. of the total membership on donation, but in the Manchester district there are not more than 1½ per cent. receiving support; in Birkenhead only one member is on benefit, whilst in Liverpool there are no members on trade donation. Reports as to the state of trade continue generally of a satisfactory character. During the past month the pattern makers in the Amalgamated Society of Engineers at St. Helens have obtained 1s. advance, and at Horwich the "demarcation" dispute between the engineers' and boiler makers' societies has been referred to the two executives. The award in the Mid-Lancashire engineering trades arbitration has now been given in favour of the men, who will consequently retain the advance in wages of one shilling per week which pending the decision of Lord James had only been granted temporarily and conditionally.

On September 2nd the paddle steamer *Mabel Grace* had a very satisfactory trial trip. She has been built and engined by Messrs. Laird Brothers for the South-Eastern Railway Co. for their service between Folkestone and Boulogne. Messrs. Laird's connection with this service commenced as long ago as 1846, when they turned out the s.s. *Princess Clementine*, *Princess Helena*, and *Lord Warden* for the South-Eastern Railway. These vessels were amongst the fastest and most successful of their day, and the *Princess of Wales*—the last steamer the firm built for this service — has also given exceedingly satisfactory results.

The Unbreakable Pulley and Mill-Gearing Co., West Gorton, Manchester, have recently completed a special order for countershafts for machinery requiring great exactness in speed, ratio, and frequent and easy stopping and starting. The shafts are carried in the company's standard bearings, the self-adjusting properties of which ensure absolute alignment and evenness of pressure, whilst economy is also secured in erection, lubrication, power, and repairs. The countershafts carry one of the company's patent equal-pressure friction clutches, in which the power from the sliding sleeve on the shaft is transmitted to the clutch in such a manner that the force given to each of the two friction blocks is mathematically equal, and it is claimed that these clutches overcome all the difficulties of unequal wear, and the trouble of engaging and disengaging incidental to this class of mechanism.

Messrs. W. Bailey & Co., Oxford Street, Manchester, have designed a new form of search-light to burn acetylene gas, which will be found very useful for illuminating purposes in works, shipyards, docks, and other places where a strong, steady, and brilliant light is required. In this search-light the generator is on the double principle, so that a continuous supply of gas can be maintained for any length of time, as the recharging can be performed whilst the machine is in action; and the apparatus is also so constructed that the rate at which the gas is consumed regulates the feed of water to the carbide, thereby preventing any excessive production of gas. The reflector of the search-light is detachable, and can be readily fixed in any convenient position, and connected wi generator by indiarubber tubing. The apparatus is portable, and requires no attention whilst working. The standard sizes range from No. 1, to give 500 candle-power for 18 hours, to No. 3, to give 2,000 candle-power for 14 hours.

During the past month a steadier tone has come over the iron market here. With regard to pig iron, Lincolnshire makers early in the month reduced their list rates 2s. per ton, but with this exception makers have held pretty firmly to their quoted rates, and, although there has been only a very slow hand-to-mouth sort of inquiry stirring, they are generally so well sold that they are under no necessity to press sales. In the open market, however, prices are very irregular, merchants under-quoting makers for any orders that are to be got, and in many cases they continue exceedingly low sellers for delivery next year. Local makers' quotations remain nominally at 77s. 6d. less 2½ for foundry, delivered Manchester. Lincolnshire makers report a fair inquiry for foundry, and they are firm at their reduced quotation of 71s. 6d. net, whilst special prices, ranging from 77s. to 78s. net for some brands, are being quoted by Derbyshire makers for delivery Manchester. Forge qualities are in active request, with prices tending to harden on the rates ruling in the early part of the month, Lancashire being quoted 72s. 6d. to 73s. less 2½, and Lincolnshire 70s. 8d. to 71s. 2d. net cash, delivered Warrington. Middlesbrough has hardened up if anything, 76s. 4d. net being now the average quotation for delivery by rail Manchester. Prices for Scotch iron vary considerably; but the average figures for Eglinton and Glengarnock, delivered Manchester Docks, may be given at about 78s. to 78s. 6d. net per ton. Quotations for American pig rion are practically withdrawn until it is seen what quantities are likely to come over.

In the finished iron trade a good demand comes forward generally, and prices all round have been advanced. Bars are 5s. up, Lancashire qualities being now £8 10s., delivered Manchester or Liverpool; and North Staffordshire, £8 15s, delivered here. Sheets are also dearer, and for good qualities £9 17s. 6d. to £10 is asked. For hoops list rates have been raised 10s. per ton, making the basis £8 15s. f.o.b., Liverpool, and £8 17s. 6d. for random to £9 2s. 6d. for special cut lengths, delivered Manchester district.

In the steel trade makers' prices for hematites receded about 2s. at beginning of the month but have now got back to 87s. 0d. and 88s. 0d. less 2½. Billets have hardened up, and now average £6 12s. 6d. net, whilst for bars local makers are 5s. dearer, £8 and £8 2s. 6d. being now quoted, with special qualities up to £8 15s. 0d. Steel hoops have been advanced 10s., making the basis £9 10s., and boiler plates are firm at about £9 10s. to £9 12s. 6d., delivered Manchester district.

Manufacturers of metal goods report an active inquiry for marine and general engineers' and boiler makers' and locomotive builders' requirements, and list rates are firm at late quotations. Delivered Manchester district, solid drawn brass boiler tubes remain at 9d.; condenser tubes, 10½d.; copper tubes, 11½d.; brazed copper gas and steam tubes, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d.; common brass wire, 8½d.; and copper wire, 10¼d per lb.

The timber trade is active, and values of most of the leading articles have shown an improvement. The import has been large, but deliveries generally good, and stocks, though increasing, are with few exceptions not excessive. Teak squares have arrived in small quantities, and the demand is fair, with prices firm, and stocks not large. Planks are in moderate request at steady prices, but stocks are increasing. One cargo of greenheart has arrived; the stock is still too heavy.

In the coal trade there is a general advance in prices with the close of the mouth, round coals being put up 10d. to 1s., and burgie and slack 5d. to 6d. per ton. In anticipation of this upward move there has been a greatly increased demand, consumers evidently having been anxious to get in supplies before the rise. The increased enquiry has been chiefly noticeable in house coals, which had previously been hanging, and the output of these has been moving away, although pits have gone on to full time. The lower qualities of round coal have continued in brisk demand, for steam and forge purposes, and with the extra enquiry for domestic consumption supplies for manufacturing requirements have been necessarily restricted. For engine fuel business has also been very pressing, with supplies, notwithstanding the large quantity of round coal now being screened, barely adequate to meet the wants of customers. At the pit's mouth prices now average about 12s. 6d. to 13s. 6d. for best Wigan Arley; 11s. to 12s. Pemberton four feet and seconds Arley; 10s. to 10s. 6d. common house coal; 10s. steam and forge coal; 7s. to 7s. 6d. best slack; 6s. 6d. to 6s. 9d. for medium, and 6s. for common sorts at the pit.

Shipping is tolerably brisk, with steam coal averaging 10s. 6d. to 11s. delivered Mersey ports.

Coke is steady at about 18s. to 20s. for furnace sorts and 26s. to 27s. for foundry qualities at the ovens.

THAMES.

(*From our own Correspondent.*)

Babcock & Wilcox.—The full trials have now been made of the machinery of the *Sheldrake*, H.M. torpedo gunboat of the *Salamander* class, which has twin screws and triple-expansion engines of 3,500 I.H.P. collectively. The cylinders are of the following dimensions: 22 in. high pressure, 33 in. intermediate, and 49 in. low pressure, the stroke being 21 in. The boilers are in two compartments, which are divided by a watertight bulkhead, two boilers being in the forward compartment, and two in the after compartment. Each pair of boilers is placed back to back, each boiler having its own stokehold. The boilers are fired fore and aft. The total heating surface in each boiler is 2,356 square ft., and the grate surface 63 square ft. The boilers are worked at 200 lbs. per square inch, which is reduced by reducing valves to 150 lbs. per square inch at the engines, and the steam on its way to the engines passes through separators. The boilers are composed of 19 sections of tubes. The tubes are of solid-drawn steel, galvanised on the outside by the electro-deposition process in accordance with the usual Admiralty requirements. The tubes connecting the headers are 7 ft. 6 in. long. The uptake headings are connected to the steam and water drum, and connected to a wrought-iron mud-box, this box being provided with blow-off drain valves. The level of the water in the drum is regulated by Thornycroft's feed regulators. Four 6 ft. double-inlet fans are arranged, driven by engines 6½ in. by 5 in., and capable of making 600 revolutions per minute, so as to increase the draught. There is a common uptake, and a funnel for each pair of boilers, the inside diameter of the funnel being 5 ft., and its height above the grate bars, 45 ft. The guarantee of the makers to the Admiralty was that each boiler would evaporate with natural draught from 11,000 to 12,000 lbs. of water per hour, with Welsh coal, and with the feed-water at 110 degs. Fahr. With forced draught not exceeding 3 in. of water, the guarantee was an evaporation of from 18,000 to 19,000 lbs. of water per hour from 110 degs. Fahr. for two hours. Different trials were made of the boiler under the direction of the Admiralty officials. A steam jet was first used in the funnel to produce a draught, and with a pressure equivalent to ¼ in. of water the evaporation was 19,577 lbs. of water per hour, from 70 degs. Fahr.—the equivalent from 110 degs. Fahr. would have been 20,250 lbs. During this trial the rate of combustion per square foot of grate surface was 40·7 lbs. The weight of refuse taken from the ashpans in a wet state was 14 cwt. 2 qrs., or about 20 per cent. of the total fuel put in the grate. The temperature of gases in the funnel was 650 degs. The pounds of water evaporated per square foot of heating surface per hour were 8·3, and the pounds of water evaporated per pound of combustible per hour from and at 212 degs. were 11·28.

In another trial, when the draught was ·2 in., and the quantity of coal burnt per square foot of grate surface was 22·5 lbs., the evaporation per square foot of heating surface was 5·18, and the pounds of water evaporated per lb. of combustible from and at 212 degs. were 12·72. The temperature of the gases in the funnel was 550 degs. On her first sea-going trial of eight hours the consumption of coal was fixed at 15 lbs. per square foot of grate per hour. The pressure of steam in boilers was 152½ lbs., and in high-pressure cylinders it was 122 lbs., the vacuum was 25·8 in.; draught, ·2 in.; temperature of gases in funnel 550 degs.; average I H.P., 2,642; revolutions, 242; speed of gunboat, 7·9 knots; coal consumed per I H.P., 1·429 lbs.; heating surface in square feet per I.H.P., 3·5. With a full-power trial the pressure draught ½ in. of water, at furnace and at base of funnel it of steam in boilers was 151 lbs.; high-pressure casing, 137; was 3 in. of water; temperature of escaping gases, 550 degs. Fahr.; the average I.H.P., 4,050; revolutions, 280; speed in knots per hour, 20·6; coal per I.H.P., 1·57; heating surface in square feet per I.H.P., 2·3.

We have just been supplied with the results of the official trials of H.M.S. *Sheldrake*, consisting of nine 1,000-mile runs at various rates of steaming:—

Date.	Nature of Trial.	Duration in Hours.	Steam Pressure.	I.H.P.	Air Pressure.	Coal per I.H.P. all purposes.	Coal per sq. ft., Grate.	Water per lb. Coal.	Ashes per lb. Coal.	Grate surface.
28—2—99	1,000 miles at 1,500 I.H.P.	69	120	1,303	·0	1·61	12·3	—	·152	189
9—3—99	" " "	68	120	1,506	·0	1·6	12·67	—	·150	189
28—3—99	" " "	70	135	1,534	·0	1·75	14·2	—	·200	189
20—4—99	" " "	68½	130	1,539	·0	1·59	15·1	—	·150	189
5—5—99	1,000 miles at 1,800 I.H.P.	67	135	1,829	·0	1·6	15·4	—	·216	189
19—5—99	" " "	66½	140	1,838	·0	1·68	16·4	—	·220	189
15—6—99	1,000 miles at 2,000 I.H.P	59	145	2,033	·0	1·57	17·0	—	·220	189
3—7—99	" " "	61½	140	2,042	·0	1·56	16·8	—	·230	189
20—7—99	1,000 miles at 2,150 I.H.P.	56¾	150	2,245	·0	1·63	19·4	—	·250	189
	TOTAL	632¾	—	—	—	—	—	—	—	—
	MEAN	—	146	1,974	—	1·63	9 85	—	·198	—

At the finish of the thousand-mile trials, several experiments were made. The first one was made on the forward boiler, when the time required to raise steam at 140 lbs. pressure from cold water was taken; the temperature of the water at the start was 70 degs., and steam was raised to 140 lbs. pressure in 23 minutes. After that a stopping and starting test was made; the engines were going full speed and suddenly stopped. The front tube doors and uptake doors were immediately opened and the ashpit doors closed; the steam gauge was then watched and the pressure did not rise more than 5 lbs., neither did the safety valves lift.

The next test was made to ascertain how soon the operation of drawing a tube could be commenced after the fires were pulled out of the furnace. No 4 boiler was used for this purpose. This boiler was worked at full power, suddenly the fires were drawn and the water blown out; in 24 minutes after drawing the fires several caps were taken off ready for drawing tubes. Then a test was made to show how quickly a tube could be taken out of a boiler. Three tubes were drawn one after the other; the first took 11 minutes, the second 10 minutes, and the third 9 minutes.

At the conclusion of these experiments, the *Sheldrake* had completed the whole of the Admiralty programme and returned to Devonport, where a careful examination was made of the boilers which were found to be in as good a condition everywhere as when they left the works.

Vauxhall Iron Works Co.—This company has on hand a number of sets of compound engines of their usual type, and they have also one set of large triple-expansion engines.

Tolch & Co. have completed the oil launches for the coastguard service of the Egyptian Government. These launches are large, and can easily accommodate 20 people. They are 33 ft. in length and 7 ft. 9 in. wide, with 3 ft. draught. The engines are of a strong and massive construction, giving 12½ I.H.P., and on the brake 10 H.P. The two cylinders are each 8 in. diameter, and the stroke is 8 in. When going at her normal speed the engines made 240 revolutions. The boats are intended to make 9 knots an hour. The firm have some new work in prospect, and intend to extend their premises.

Auxiliary Steam Power Co.—This company are fitting up their arrangements at the waterworks, Romford. It is known that they use a mixture of C O_2, which they force under pressure into the water to be used in the boiler. Results of trials have shown that a considerable economy is affected by the arrangement. Anyway the gases will be thoroughly tried at Romford.

Thompson Brothers, of Fenchurch Street and Millwall, have lately introduced a new feed-heater. This is a novel kind of feed-heater, quite unlike the ordinary forms. There is a cylindrical shell, and a number of pipes let into it. These pipes are stopped at the bottom end, and a diaphragm goes down the middle. Just below the top cover there is a branch pipe at the side for the admission of the water. Passages are cut at the top ends of the pipes, and the water flows down one side of the pipe, flows round the bottom, and up the other side of the pipe. When the water gets to the top of the first pipe it goes into the next in order, down one side and round the bottom and up the other side of the diaphragm, and so on. When the water comes out of the last pipe it flows out by a branch into the boiler. The temperature of the water after it has gone through this feed-water heater is easily 270 Fahr. and it keeps that temperature with regularity. It has reached in some instances 300 degs. and even has gone above that, but the makers prefer it to go into the boiler at a temperature of about 270 degs. Fahr. One of these heaters has been fitted on a steamer, the engines indicating 1,000 H.P. The length of the heater is 2 ft. 8 in., and diameter some 14 in. Before the heater was fitted, the steam was difficult to keep up at the pressure required, and it was spoken of by the engineers as a hard job to stoke. Since, however, the feed heater has been fitted on, the condition of things has changed. The engineer says he has obtained one and a quarter more revolutions per minute, and several pounds of steam higher on the gauge, and the stoking is considerably easier.

Maudslay & Field.—This old firm (is it the oldest engineering firm on the Thames ?) is at last leaving the Westminster Bridge Road, and going to settle at Ipswich. It has made some of the very largest of marine engines. Engines of as much as 20,000 H.P. have been built in these shops. But the locomotive department of the London and South-Western Railway have had longing eyes on the place, and at last have persuaded the company to part with them.

John I. Thornycroft & Co.—The great international yacht race, in which this country will be represented by the *Shamrock*, built by this firm, comes off on October 3rd. There will be five races over courses of 30 miles in length, and with a time limit of six hours. The probable point of start will be off Sandy Hook Lightship to and from a mark 15 miles to windward or to leeward. The first race will be round an equilateral triangle. one leg being to windward. The present is the tenth contest for the cup. Some important figures have been lately published by the *Times* with respect to the dimensions of the two vessels:—

	Shamrock ft. in.	*Columbia.* ft. in.
Length, over all	127 9	131 4
Breadth, extreme	24 6½	24 2½
Length, on load water-line	89 2	—
Length of overhanging aft	21 5	—
Area midship section	130 sq. ft.	120·48 sq. ft.
Co-efficient of midship section ..	·278	·258
Area of lateral plane	970 sq. ft.	885 sq. ft.
Co-efficient of displacement ..	·134	·1206
Area load water-plane	1,493 sq. ft.	1,509 sq. ft.
Wetted surface, total	2,916 "	2,670 "
Tons per inch immersion	3·34	3·59
Draught	20 ft. 3 in.	20 ft. 3 in.
Displacement..	160 tons	145 tons.

The sail area of the *Shamrock* is 13,850 square feet. It is built of steel, aluminium, and bronze; the frames of steel angle, they are spaced about 20 in. The deck beams are special torpedo-boat steel angle-bulbs, and attached to the frames with gusset pieces. The stem and stern are bronze castings, and the rudder is of the same material. The fin is hollow and just sufficient to allow a man to get in. A lead casting of 80 tons weight is bolted to the bottom. This casting is rectangular, and so trims its centre of gravity.

BELFAST.

(*From our own Correspondent.*)

MUCH has been said and written regarding the *Oceanic* for months past, and we have now to chronicle her departure from her birthplace on the 25th of August. If fine weather during her gala days can be taken as an omen for her future prosperity, then indeed she has been fortunate. As this big leviathian left Victoria Wharf, and proceeded down the Belfast Lough for a trial and adjustment of compasses, the sun shone out brilliantly, and she was watched from both sides of the river by many hundreds of people. She was accompanied by three of the largest Liverpool tugs, and the channel was kept entirely clear of shipping for two hours during her progress down the river. On reaching broader waters she was put under her own steam, and during her trial everything in connection wrought very satisfactorily. After getting some finishing touches she left for Liverpool on August 26th. She has now made her maiden voyage across the Atlantic, and, although not a record for speed, still she has accomplished all that her owners and builders desired of her. So much has been said and written regarding this large and magnificent vessel in the past, we can only hope that in the future she may prove a source of both pleasure and profit to all concerned with her.

On the 7th September Messrs. Harland & Wolff launched another very large vessel, named the *Persic*. She is a sister ship of the *Afric* and *Medic*, and is intended for the White Star Australian service, her length being 550 ft.; beam, 63 ft.; depth, 44 ft.; and about 12,000 tons gross register, and her displacement will exceed 20,000 tons. We may mention that the Chambers of Commerce Association meeting being held in Belfast at this time, many of the members and their friends availed themselves of the opportunity of witnessing the launch of so large a vessel, which was most interesting: the *Persic* being constructed in the south end of the Queen's Island, and having to be launched into Abercorn Basin, this space was so limited that the vessel had to be brought up immediately on being afloat. This, however, was accomplished in the firm's usual masterly style without a hitch. Afterwards the members of the above association were shown over the large works by Mr. Wilson and Mr. Carlisle, and finally were entertained to luncheon by Mr. and Mrs. Wilson.

In regard to Messrs. Harland & Wolff, many rumours, both in the Press and elsewhere, have been afloat concerning the removal of part of their works to other ports, due to the want of ground accommodation here, which, it is alleged, the Belfast Harbour Board have refused to give. We hope there may be no truth in regard to these reports, but certainly after the Musgrave channel, or dock, is finished at the back of Messrs. Harland & Wolff's works, it will be impossible for them to obtain more ground unless at a very great disadvantage. It is to be regretted that the Belfast Harbour Board cannot see their way to let Messrs. Harland & Wolff have the required ground, since it is well known that Belfast owes her position in the commercial world to the shipbuilding and engineering industries carried on here. However, we hope that some amicable arrangement may be arrived at.

Messrs. Workman, Clark & Co., Limited, launched another addition to the Allan Line, of Glasgow, during the past month. She is the second of three large cargo steamers which this firm have in hand for this line, and is named the *Sicilian*. At present she lies at the large crane receiving her masts and machinery, and will shortly be ready for sea, when we hope to give a more detailed account of her dimensions.

The s.s. *Star of Australia*, built by Messrs. Workman, Clark & Co., went down the Belfast Lough on the 7th September for adjustment of compasses and trial trip.

The s.s. *Turkoman*, lately called the *Lord Erne*, has been in the hands of Messrs. Harland & Wolff for almost two months receiving extensive alterations and deck fittings of the newest style, suitable for carrying cattle in the Atlantic Transport Co. service, which recently purchased her. She is about ready for sea, and will leave here in a few days.

The smaller engine works and foundries are feeling the dulness in the building trade, they being very much quieter than they were some months ago.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*

Barrow.—There is not much that is new to report in connection with the shipbuilding trade of this district. Messrs. Vickers, Sons & Maxim are very busy on an important number of big orders, and they are making considerable progress with the work. They are, however, severely handicapped by the scarcity of skilled workmen, and the cause for this is found in the great want which is still felt for houses for workmen in Barrow. I have previously notified that in order to find homes for their men this firm adopted the unique idea of buying the old Atlantic liner *Alaska*, with the view of utilising her as a floating house for their workmen. She will accommodate about 400 men, and already upwards of 100 are housed on the ship, and preparations are being made for an additional 100 forthwith. This ship is found to be a very popular home, and the men who are housed in her speak of the great comforts they enjoy, the liberal bill of fare which is provided for them, the cleanliness of the ship, and of the care that is taken of them in the washing of their clothes, and the mending of the same. The modest sum they pay, and the convenience they experience, render their lot a much happier one than would be possible in ordinary lodgings in the town, but of these there are very few to be had.

Yet the *Alaska* will not provide for all the needs of workmen, and therefore the firm are about to build 1,000 houses. Already tenders are being received for the first 200 of these, to be built on Walney Island. Some delay has been caused in getting out the plans, laying out the estate, and in a thousand and one preliminaries incidental to such an enterprise, but things are now getting into shipshape. A brickmaking plant is being put down, which will produce about 25,000 bricks per day. Many men who are engaged to start work at Barrow go away again because the town is so full, and the difficulty of getting housed is so great. In other parts of the town about 200 houses are in course of erection, and as much speed as possible is being exerted in order to get these houses ready for early tenancy. Not until this difficulty of house accommodation is removed will Messrs. Vickers be able to make that progress with business it is their desire and their intention to make. Gradually, however, the men will get housed, and by that time it is expected the population of Barrow, which a few years ago was at 55,000, will have reached from 70,000 to 75,000 souls.

Notices have been issued by the dock authorities at Barrow that the Ramsden Dock lock sill is about to be lowered 6 ft., so as to make a fairway into the docks 30 ft. in depth. The docks will then be able to take in the largest ships afloat, and thus Messrs. Vickers will be able to build the largest possible ships and get them safely docked and undocked. The work in hand at present by Messrs. Vickers will in itself demand this deep water accommodation, and it is certain the ships to be built at Barrow in future for the Admiralty, for foreign Governments, or for the mercantile marine, will be in very many cases as large, for instance, as the 15,000-ton battleship now building here for the Japanese Government. The improved accommodation for shipping will also draw to Barrow larger vessels in the way of commerce, as well as the largest ships afloat to come here for repairs. The first-class cruiser *Hogue* is beginning to lift her upper ribs. She is in a much more forward state than her sister ship, the *Eurylas*, or the still more recent order, the *King Alfred*. These cruisers, together with the Japanese battleship, will not be launched until the deep water sill has been built in the Ramsden Dock. This important engineering work, which will be commenced in November, will probably take six months to complete. In the meantime deep-draught shipping will be accommodated in the Ramsden Dock entrance basin, and smaller craft will enter and leave the Barrow docks by means of the Devonshire Dock basin. This work of deepening the sill will be of great importance to the trade of Barrow in the future and to the shipping business as well; but it does not represent the ultimate enterprise of the Furness Railway Co. as one of the largest and deepest graving docks in existence is to be built at a future date. This in itself will bring commercial and Admiralty repairs to Barrow when completed.

The Pacific Steam Navigation Co.'s steamer *Ortona* is approaching completion. She will be ready for her trials in November. Her engines have already been at work, and her internal fittings are in a very forward state. She is magnificently fitted up, and will certainly be the handsomest as well as the largest Orient liner in the service.

Mr. Zimmermann, the general manager of the Vulcan Shipbuilding Yard in Germany, paid a visit to Barrow last month to see his many friends who were employed with him by the now defunct Barrow Shipbuilding Company. He is very proud of Barrow and of the Lake District. He has made great progress in his profession since leaving here, and he has the honour of having built the *König Wilhelm der Grosse*, which holds the Atlantic record until the White Star liner *Oceanic* takes it from her. Then he proposes to go one better even than the new Cunarder. He is at present building two Atlantic liners larger than the *König Wilhelm der Grosse*.

West Cumberland. — The shipbuilding trade of West Cumberland is busily employed, and both at Workington and at Maryport the yards are as full of work as their capacity of production will justify. On September 7th Messrs. Williamson & Sons launched from their yard at Workington the screw steamer *Gipsy* built to the order of the Waterfold Steamship Co. The firm has several other ships in course of construction. Messrs. Ritson, of Maryport, have several small vessels on the stocks, and report a fair enquiry for the class of tonnage they usually build. Prospects of West Cumberland shipbuilding are very good, and hopes are entertained at Whitehaven, now that the harbour authorities are about to dredge the harbour, that the old shipbuilding yard at this place will be resuscitated. As I have before said, the only way by which this can be done is for local capitalists to raise the necessary funds and put the business in the hands of a competent manager.

Shipbuilding Material.—Although no great amount of new tonnage is being ordered from shipbuilders, they maintain a very brisk demand for all classes of shipbuilding material. The fact of the matter is that makers have been so largely sold forward for some time that they could not accept orders for the delivery of many specifications required by builders, and these are being taken according to the urgency of their needs. Ship-plates of both heavy and light classes are in large output, and the orders held will keep the mills going for many months to come. Heavy plates are firm at £7 12s. 6d. per ton, and light plates realise about £8 15s. to £9. Angles are at £7 2s. 6d., but the production in this district is not large. A good business is, however, being done in sections. Boiler plates are in very full demand at £8 15s. per ton. There is a brisk demand for steel forgings, and it is probable some attention will be devoted to this branch of trade in the early future, as they are largely required by shipbuilders here. Heavy steel castings find a very good market, and the recently enlarged foundries here are not yet fully equal to the demand made upon founders. Miscellaneous steel products are in brisk request all round.

The Hematite Trade.— Business in hematite pig-iron has been on a large scale during the month, and the presence of American buyers in the district has tended to give firmness and life to the market. Some large parcels have already been bought by buyers from the United States and Canada. A parcel of over 6,000 tons has already been dispatched, others are on order, and buyers are endeavouring to make arrangements for large forward deliveries. The value of pig-iron has gone up, and is now quoted at 77s. 6d. for mixed Bessemer Nos. net free on board, whilst warrant iron sellers are at 74s. 6d. net cash, and buyers at 74s. 5d. The market shows buoyancy. Forty-six furnaces are in blast, as compared with 41 in the corresponding week of last year. Warrant stocks have been increased during the year by 56,457 tons and are now standing at 232,436 tons. Makers do not hold more than about 30,000 tons of iron in stock, and much of this is bespoken for steel manufacturing purposes. There are indications that the hematite pig-iron trade will remain brisk for some time to come, as not only are orders very largely held, but the wants of steel-makers are considerable and likely to be so, and the American demand is likely to be supplemented by a general foreign demand for Bessemer descriptions of metal.

Shipping.—Business in the shipping trade of this district has not been so briskly maintained as during the previous year. The total exports are shown to have reached 355,160 tons of pig-iron and 350,329 tons of steel, as compared with 375,615 tons of pig-iron and 396,461 tons of steel in the corresponding period of last year, showing a decrease of 20,455 tons of pig-iron and 46,132 tons of steel. Freights are very satisfactory, and shippers experience no scarcity of cargoes. Trade is of such volume, although less than last year, that shippers are not hesitating in increasing their tonnage of carrying capacity.

RIPOLIN PAINTS.

WE have lately had the opportunity of inspecting some work executed with the paints which are manufactured and sold by Ripolin, Limited, of 110, Fenchurch Street, London; Amsterdam and Paris.

The Ripolin paint is prepared ready for use, and is designed to combine with great glossiness a high power of resisting atmospheric influences, steam, heat, ammonia vapours, &c. We understand it does not crack, split, or scale off, and can be washed without losing its porcelain-like gloss. It is stated that even in the tropics Ripolin paint has proved durable under the most unfavourable conditions of sun, wind, and weather.

As an evidence of its efficiency it may be stated that several of the well-known yachts are painted with Ripolin, as the s.s. *Erin*, *Valiant*, &c.

As a decorative agent its capabilities are considerable, and its effect is really splendid, as its appearance is as handsome and solid as enamelled tiles. From a sanitary standpoint it is decidedly good, as it fills up all the crevices and cracks in which microbes and dust can collect, and will bear washing with strong antiseptic solutions. By reason of its high gloss, varnishing is dispensed with. It is very elastic, and therefore does not become detached or scale off. It can be made if desired to give a flat surface instead of a glossy one. It dries in about 10 to 12 hours after application.

The Ripolin Co. manufacture two compositions for submarine work under the title of Rieps compositions. One composition is anti-corrosive, and the other anti-fouling. We have had the opportunity of reading a number of testimonials, and it is interesting to note what the marine superintendent of one of our largest railway companies, says of these paints. He states that he has been using the Rieps composition for the last 12 months on the bottom of the steamers under his supervision, and it has given such entire satisfaction that after this trial its use will be continued on all the vessels. He has also used Ripolin paint on enclosed and exposed surfaces, and, although subjected to considerable wear and tear and severe weather tests, it has worn exceedingly well, has not cracked, and has given such satisfaction that its use is to be continued and extended.

Correspondence.

[*We do not in any wav pledge ourselves to the opinions proffered under this heading.*—Ed. M.E.]

THE SHANGHAI ENGINEERING, SHIPBUILDING, AND DRY DOCK CO., LIMITED.

To the Editor of The Marine Engineer.

Dear Sir,—Permit me to bring to your notice the fact of the opening of the Shanghai Engineering, Shipbuilding, and Dock Co's. "Oriental" Dry Dock, Shanghai, which dock is now in constant use. As you are doubtless aware, it has hitherto been considered unsafe to dock very heavy ships in Shanghai. This difficulty is, however, now removed, as the "Oriental" Dock, owing to its strong construction, is capable of taking the heaviest steamers which can use the port.

Amongst the steamers already docked are s.s. *Palatinia* of 3,620 tons, and the Norddeutscher Lloyd s.s. *Königsberg* of 4,855 tons. The *Königsberg*, when docked, had on board about 2,500 tons of cargo, giving a total weight on the blocks of over 7,000 tons. In addition to these vessels, an Italian man-of-war has also used the dock.

From these particulars it will be apparent that no hesitation need be entertained in docking the largest steamers, even should these have several thousand tons of cargo on board. In connection with the dock are extensive and conveniently arranged workshops, equipped with the most modern plant and contrivances for the expeditious and economical executing of light and heavy repairs to hulls, engines, and boilers.

I am,
Yours faithfully,
E. G. Constantine.

17, St. Ann's Square, Manchester,
September 16th, 1899.

[We give in this issue, on page 310, an illustrated article on the "Oriental" Dry Dock and Works, Shanghai.]

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Persian Empire.—On August 21st there was launched at Hull for the Cargill Steam Trawling Co., Limited, Hull, an iron steam ketch, named the *Persian Empire*.

King Edgar.—On August 23rd there was launched at Grimsby for the Monarch Steam Fishing Co., Limited, Grimsby, a steel steam trawler, of about 185 tons gross, named the *King Edgar*.

Bristol City.—On August 24th there was launched by Messrs. Charles Hill & Sons, at Cumberland Road, Bristol, a fine steamer built for the Bristol City Line of steamers, owned by Messrs. Hill & Sons, and running between Bristol and New York. This vessel is the 16th steamer built for the above line. She is 310 ft. long, 40 ft. 6 in. broad, 26 ft. moulded, and is the largest ship that has ever been built in the old city of Bristol, as she will carry close on 4,000 tons deadweight. She is fitted with triple-expansion engines by Messrs. Blair & Co., Stockton-on-Tees, with cylinders 24 in., 40 in., and 66 in. by 45 in. stroke, and two boilers 16 ft. in diameter and 10 ft. 9 in. long, with a pressure of steam equal 160 lbs., which will develop 1,400 H.P. She is built in advance of Lloyd's requirements to suit the Atlantic trade. The new steamer, which was christened the *Bristol City* by Lady Hill, is a sister ship to the *Bath City*, built for the same firm, and which was launched from Messrs. J. L. Thompson & Sons' Sunderland Yard, in July of the present year.

Isel Holme.—On August 24th there was launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, Limited, Sunderland, a handsomely modelled steel screw steamer, built to the order of Messrs. Hine Brothers, of Maryport, and the 18th vessel built by this firm for these owners. The principal dimensions are:—Length, between perpendiculars, 368 ft.; breadth extreme, 45 ft. 10½ in.; and depth, moulded, 28 ft. 4 in. She has been built under special survey on the three deck rules for Lloyd's highest class, the requirements for same having, in many important particulars been exceeded. She is built on the deep-frame system, dispensing with hold beams, thus facilitating the rapid loading and discharging of steel rails and timber cargoes; she has a cellular double bottom right fore and aft, for water ballast, which is also carried in the fore peak, the tank under the engines is fitted with watertight centre dividing plate for trimming purposes, and for carrying fresh water for cattle. The accommodation for saloon, captain, and a limited number of passengers is fitted in a large steel midship house placed on top of the bridge at the forward end, the chartroom and steering house being fitted above this. The accommodation for the officers and engineers is in side houses at the after end of the bridge, the crew, firemen, and petty officers being berthed in the topgallant forecastle. The deck machinery consists of eight steam winches; a large steam windlass on the forecastle head, and the steam-steering gear fitted at the after end of the engine casings, connected by controlling gear to the fore end of the bridge. This deck machinery is supplied with steam by a multitubular donkey boiler. The vessel is rigged as a two-masted fore and aft schooner with telescopic topmasts to suit the Manchester Canal. She has a clipper stem, with figurehead and elaborately carved trailboards. The engines and boilers have been built by Messrs. George Clark, Limited, of the Southwick Engine Works, having cylinders 24 in., 40½ in., 68 in. by 45 in. stroke, supplied with steam by two large multitubular boilers working at 180 lbs. pressure. The vessel and machinery have been constructed under the personal supervision of Captain George Brown, the owners' superintendent. The vessel was gracefully christened and launched by hydraulic power by Mrs. J. L. Thompson, of Winston-on-Tees. There were also present at the launch: Mr. J. McL. Hine, Captain George Brown, Mr. Robert Thompson, the managing director of the builders' firm, Mr. Charles E. Thompson, Mr. James Marr, Mr. P. Phorson, &c. After the launch, which was most successful, the company adjourned to the firm's luncheon room, where the usual toasts were duly honoured.

Shieldrake.—On August 26th the s.s. *Shieldrake*, which is being built by Wigham-Richardson & Co., Limited, to the order of the Cork Steamship Co., Limited, of Cork, was launched from the Neptune Shipyard. The steamer, which is a sister vessel to the *Jabiru*, finished a few months ago, is destined for the Continental service of the Cork Steamship Co. She is 260 ft. in length by 34½ ft. beam, and will have very comfortable accommodation for a limited number of passengers. Her engines, which are on the triple-expansion principle, are, as well as her boilers, being constructed by Wigham-Richardson & Co., Limited. The owners were represented at the launch by Mr. R. Reynolds, of Cork, their secretary, Captain Hore, of Liverpool, their marine superintendent, and Mr. J. A. Flockhart, of Liverpool, their superintending engineer, and the christening ceremony was gracefully performed by Miss Lillie Reynolds, daughter of Mr. Reynolds.

Arnage.—On September 2nd there was launched by Messrs. William Dobson & Co., at Newcastle, a steel screw steamer, to the order of the Adam Steamship Co. The vessel has the following dimensions:—Length, 337 ft.; breadth, 45 ft.; depth, 20½ ft.; and she has been built to take Lloyd's highest class. She will be fitted with triple expansion engines by the Wallsend Slipway and Engineering Co., Limited, and was christened the *Arnage* by Miss Aline Ritson, the granddaughter of the owner.

Lydie.—On September 4th Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length, over all, 323 ft.; breadth, extreme, 44 ft. 6 in.; depth, moulded, 23 ft. 1 in.; tonnage, gross, about 2,680 tons. This vessel, which has been built to the order of Messrs. Burdick & Cook, of London, will class 100 A1 on Lloyd's register, and has been built under special survey. She is of the single-deck type with deep framing, and has a cargo poop, long bridge, with accommodation for captain, officers, and engineers in iron deckhouses on bridge deck, and topgallant forecastle for crew. A cellular double bottom throughout and after peak tank are fitted for water ballast, and the equipment includes extra large multitubular donkey boiler, eight steam winches, double derricks to hatches, steam-steering gear, steam windlass, stockless anchors, and all modern improvements for facilitating loading and discharging. The engines, by Messrs. Blair & Co., Limited, have cylinders 24 in., 40 in., and 65 in. by 42 in. stroke, steam being supplied by two single-ended boilers, having a working pressure of 160 lbs. On leaving the ways the vessel was named *Lydie* by Miss Lydie Burdick. There were also present at the launch: Mr. and Mrs. Cocquerel Mr. and Mrs. Ellis, of London, Madame Ratheau, of Paris Mr. T. J. Templeman, Mayor of Weymouth, Mr. and Mrs. J. Burdick, Miss Ethel Burdick, and Mr. Cook.

H.M.S. Viper.—On September 6th there was launched by Messrs. R. & W. Hawthorn, Leslie & Co., at Newcastle, H.M.S. *Viper*, a torpedo-boat destroyer of 31 knots guaranteed speed. The vessel is being fitted with Parsons's steam turbine machinery, whilst the hull and boilers have been constructed by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, to the order of the Parsons Marine Steam Turbine Co., Limited, to whom the contract for this vessel was entrusted by the British Admiralty last year. She is expected to be ready for her official trials in the course of about six weeks. The Hon. Mrs. Parsons performed the christening ceremony.

Sunningdale.—On September 6th Messrs. Austin & Son, Limited, launched at Sunderland the steel screw steamer *Sunningdale*, which has been built to the order of Sir James Joicey, Bart., M.P., and partners, to be placed under the management of Messrs. John Fenwick & Son, of Gracechurch Street, London. This vessel is built of steel to class 100 A1 under special survey in Lloyd's register, her dimensions being as follow:—Length between perpendiculars, 268 ft.; breadth, extreme, 37 ft. 7 in.; and depth, moulded, 19 ft. 9 in.; and is estimated to carry a total deadweight of 2,600 tons. She is to be employed largely in the coal trade, and the hatchways are fitted for self-trimming. The machinery, which will be supplied by Messrs. George Clark, Limited, Southwick Engine Works, is of the tri-compound type.

Trevessa.—On September 6th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a new screw steamer built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall. The vessel, which is 353 ft. long, 46 ft. 6 in. broad, and 27 ft. 4 in. in depth, is of the improved single-deck type, and classed 100 A1 at Lloyd's under special survey. She has a cellular double bottom fore-and-aft for water ballast, and is fitted with all modern improvements for rapid loading and discharging of cargo. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 24 in., 40 in., and 65 in., with 45 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch. The steamer was named the *Trevessa*, and is the 35th vessel built for the above firm by Messrs. John Readhead & Sons.

Saxoline.—On September 6th this vessel, built to the order of Messrs. Lane & Macandrew, on behalf of MM. Fenaille & Despeaux, by Sir W. G. Armstrong, Whitworth & Co., Limited, was successfully launched from the builders' yard at Walker-on-Tyne. The principal dimensions are: 335 ft. long, 45 ft. broad, and 29 ft. 6 in. moulded depth. The *Saxoline* is the last of three sister ships building by Messrs. Armstrong for Messrs. Lane & Macandrew, and has been specially constructed for the carriage of petroleum in bulk under the direct supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and to the highest class of Bureau Veritas, and conforms to the Suez Canal regulations. After the launch the vessel proceeded to the engine builders' yard to take her machinery, which has been built by the Wallsend Slipway and Engineering Co., Limited. The cylinders are 24 in., 40 in., and 66 in., with a stroke of 48 in., and will take steam from two large single-ended boilers at a working pressure of 160 lbs. In addition she will be supplied with all the latest appliances for this class of vessel, including steam-steering gear, steam winches, steam heaters, electric light, and a powerful donkey boiler, &c.

Gipsy.—On September 7th there was launched from the yard of Messrs. R. Williamson & Son, Workington, a finely modelled screw steamer, built to the highest class at Lloyd's, for the Waterford Steamship Co., of Waterford. Her dimensions are:—Length, over all, 189 ft.; length between perpendiculars 181 ft. 6 in.; breadth, 27 ft. 9 in.; depth, moulded, 13 ft. 5 in., and designed to carry 800 tons on Lloyd's freeboard. The engines are to be supplied by Messrs Ross & Duncan, of Govan, and are of the triple expansion type, having cylinders 15 in., 25½ in., and 41 in., with a stroke of 30 in. As she left the ways she was gracefully named *Gipsy* by Mrs. R. H. Hodgson, Mayoress of Workington.

Montauk Point.—On September 7th there was launched from the yard of Messrs. Robert Stephenson & Co., Limited, Hebburn-on-Tyne, the second of two large steel screw steamers for the Norfolk and North American Steam Shipping Co., Limited, managed by Messrs. Simpson, Spence & Young, of 1, Crosby Square, London, and Newcastle-on-Tyne. The vessel is of the following dimensions:—Length, between perpendiculars, 375 ft.; breadth, 50 ft.; and depth 38 ft., moulded, to top of shelter deck. The vessel is built on the three-deck rule to Lloyd's highest class and has a long shelter bridge, poop and forecastle. The framing is on the deep-girder frame system in lieu of hold beams, so as to facilitate the stowage of cargo. The main deck is of steel; the upper deck, shelter deck, and forecastle are of iron. There is a cellular double bottom fore and aft for water ballast, also a deep tank abaft engine-room bulkhead extending from floors to main deck, also water ballast in after peak. The arrangement for the rapid loading and discharging of cargo is very complete, there being nine powerful steam winches to work the cargo, and 15 derricks. The vessel is also provided with a powerful steam windlass, steam-steering gear, and a steam warping capstan aft. Accommodation is provided for captain, officers, engineers, and passengers on top of shelter deck amidships. The crew are berthed in poop aft, and the forecastle is fitted up for the accommodation of the cattlemen. Steam heating is provided throughout all the cabin accommodation. The engines are of the triple-expansion type, having cylinders, 26 in., 43 in., 71 in., by 48 in. stroke, steam being supplied by two large multitubular boilers, which are fitted with Howden's patent system of forced draught. The working pressure of the boilers is 180 lbs. A large marine type donkey boiler, working at 180 lbs. steam pressure, supplies steam to the deck machinery. The engines and boilers are also constructed by Messrs. Robert Stephenson & Co., Limited. The whole of the work has been under the supervision of the owners' superintending engineer, Mr. John Baxter, of Newcastle-on-Tyne. On leaving the ways the vessel was gracefully named the *Montauk Point* by Miss Lovibond, daughter of one of the directors of the Norfolk and North American Steam Shipping Co., Limited.

Venetia.—On September 7th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions: 112 ft., by 21 ft., by 11 ft. 6 in. depth of hold, built to the order of the Arctic Steam Fishing Co., Limited, Grimsby. Engines of triple-expansion type are being supplied by Messrs. C. D. Holmes & Co., Hull, and the vessel will be fitted out with the most modern appliances for trawling. Mrs. E. Bacon, jun., of Grimsby, named the vessel *Venetia*, and after the ceremony the company adjourned to the offices of the builders for luncheon.

Paddle Steamer.—On September 8th Messrs. Allsup & Co., Limited, of Preston, launched a light-draught steel paddle steamer, which will be fitted by them with compound surface-condensing engines and boiler. She is intended for opening up trade in the rivers of North Russia, is built under special survey to class with the Bureau Veritas.

Nedenaes.—On September 8th Messrs. Short Brothers launched from their shipbuilding yard at Pallion a handsomely modelled steel screw steamer built to the order of Mr. C. T. Boe, of Arendal, of the following dimensions, viz.:—Length, 255 ft.; breadth, 36 ft. 9 in.; and depth, moulded, 20 ft. 4 in.; with a deadweight carrying capacity of about 2,550 tons. The vessel, which is classed A1, Det Norske Veritas, has been built for the general trade. There are four large hatchways with a powerful steam winch at each. The bottom of the vessel is constructed on the cellular principle for water ballast throughout, and is subdivided into various compartments for trimming. The captain's, officers', and engineers' accommodation is in a large house on bridge deck amidships, the saloon being handsomely fitted up in polished hardwoods and the crew in the topgallant forecastle. Every modern appliance has been fitted for the convenience of loading and discharging. On leaving the ways the vessel was named *Nedenaes*, the ceremony being gracefully performed by Mrs. Svenningsen, wife of Captain Svenningsen. The vessel is fitted with triple-expansion engines and boilers by Messrs. William Allan & Co., Limited, of Sunderland, with all modern improvements in marine engineering, the cylinders being 19 in., 31 in., and 51 in. diameter with a stroke of 36 in., the working pressure being 160 lbs. During the construction the vessel and engines have been superintended, on behalf of the owners, by Captain Svenningsen, who will take command,

Pearl.—On September 9th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions: 115 ft. 4 in., by 21 ft., by 11 ft. 6 in. depth of hold, built to the order of Messrs. T. C. & F. Moss, Grimsby. Engines of triple-expansion type will be supplied by Messrs. C. D. Holmes & Co., Hull. The vessel will be completed ready for sea with the most modern appliances for trawling. Miss Elsie Moss named the vessel *Pearl*, and after the ceremony the company adjourned to the offices of the builders for luncheon.

Stryon.—On September 9th there was launched at Hull for the Standard Steam Fishing Co., Limited, Grimsby, an iron steam ketch, of about 198 tons gross, named the *Stryon*.

Granada.—On September 9th Messrs. John Priestman & Co. launched from their shipbuilding yard at Southwick a large steel screw steamer, built to the order of Messrs. A. C. de Freitas & Co., of Hamburg, for the Argentine and Canadian cattle trade. The principal dimensions are:—Length, 410 ft.; breadth, extreme, 52 ft. 2 in.; depth, moulded, to shelter deck, 38 ft. 7 in., having a total displacement of about 11,000 tons. This vessel is intended to take the highest class in Lloyd's registry, being built to the three-deck rule grade. The water ballast is provided in a cellular double bottom right fore-and-aft, and, together with the afterpeak tank, gives a capacity of over 1,100 tons. The vessel has three fully laid decks, and on the upper and shelter deck are cattle fittings built to the new Argentine regulations for over 800 head of cattle. The electric light will be fitted, together with several electric fans, at different parts of the ship, to ensure complete ventilation, and special attention has been given to an efficient water service for the live stock. The arrangements for loading and discharging are of a very powerful and complete description. The engines and boilers will be supplied by Messrs. T. Richardson & Sons, Limited, West Hartlepool. The sizes of the cylinders are 27 in., 43 in., and 72 in., with a stroke of 48 in. Steam will be supplied by three extra large boilers, each having a working pressure of 180 lbs. per square inch. The launch was a complete success, and as the huge vessel glided down the ways she received the name of *Granada* from Mrs. Priestman.

Hillglen.—On September 19th there was launched from the yard of the Northumberland Shipbuilding Co., Limited, at Howden, a spar-deck steamer built to the order of Messrs. Hugh Evans & Co., for the Liverpool and Maranham Steamship Co., of Liverpool. The vessel is designed to carry 6,500 tons deadweight on a moderate draught, her dimensions being: 352 ft. by 48 ft. by 30 ft. dead measurement, built to the highest class at Lloyd's on the spar-deck rule. She will carry a large quantity of water ballast in peak and double bottom and after tanks, and the accommodation for captain, officers, engineers, &c., is in steel houses on the bridge deck; whilst every facility has been provided in the way of deck discharging machinery, steam winches, windlass, &c. The steamer was christened *Hillglen* by Mrs. Austin Taylor, the wife of the principal partner of Messrs. Hugh Evans & Co.

Idzumo (Japanese cruiser).—On September 19th Sir W. G. Armstrong, Whitworth & Co. launched at Elswick the Japanese first-class armoured cruiser *Idzumo*. The principal dimensions are:—Length between perpendiculars, 400 ft.; breadth, 68·6 ft.; depth, 41 ft.; draught, 24·3 ft.; displacement, 9,750 tons. Accommodation is provided for an admiral, 52 officers, and 430 petty officers and men. The armament consists of four 8-in. breech-loading guns twin-mounted in barbettes; 14 6-in. quick-firing guns—10 in casemates—six on the main deck and four on the upper deck, the remaining four being on the upper deck protected by shields; 17 12-lb. quick-firing guns—eight on the shelter decks, two on the main deck forward, four on the bulwarks, and three in the military tops; four submerged torpedo tubes—two forward and two aft. The vessel has a complete water-line belt of Harveyed nickel-steel armour 7 in. thick amidships, reduced at the ends. The machinery is of the twin-screw vertical triple-expansion type, to develop 14,500 I.H.P., and the speed guaranteed is $20\frac{3}{4}$ knots, the boilers being of the Belleville latest type. She has a bunker capacity for about 1,600 tons of coals. The vessel was named the *Idzumo* by Lady Victoria Grey, daughter of Lord Grey.

Bylands.—On September 19th Messrs. Ropner & Son, of Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length, between perpendiculars, 325 ft.; breadth, extreme, 46 ft. 6 in.; depth, moulded, 27 ft. The vessel will take the highest class at Lloyd's, and is built off the three-decked rule, having poop, bridge, and topgallant forecastle. She has been built to the order of Messrs. Jos. F. Wilson & Co., of West Hartlepool. The accommodation for the captain and officers will be fitted up in the poop, the engineers in iron houses on the bridge-deck, and the crew in the forecastle as usual. She has double bottom on the cellular principle for water ballast, and will carry a deadweight cargo of about 5,500 tons. She is fitted up with all the most recent appliances for expeditious loading and unloading, has direct steam windlass, steam-steering gear amidships, with powerful screw gear aft, six large steam winches, supplied with steam from two donkey boilers. The vessel will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of Stockton, of about 1,200 I.H.P. The christening ceremony was gracefully performed by Miss Wilson, of West Hartlepool, daughter of the managing owner, who gave the vessel the name of *Bylands*.

Arechondo.—On September 20th Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled steel screw steamer of the following dimensions, viz.: 299 ft. by 43 ft. by 21 ft. 3 in. moulded, built to the highest class in Lloyd's under special survey to the single-deck rule, with bulb angle frames, giving large clear holds for stowing cargo. The deck erections consist of poop, bridge, and topgallant forecastle, and she is fitted with water ballast in double bottom fore-and-aft, and in peak. The vessel is equipped with four double-powered steam winches, patent direct steam windlass, patent steam-steering gear, large donkey boiler, screw gear aft, telescopic masts, and all modern improvements. Her engines have been constructed by Messrs, John Dickinson & Sons, Limited, Sunderland, the cylinders being 21 in., 35 in., and 57 in. by 39 in. stroke, two large steel boilers working at 160 lbs. pressure. This vessel has been built to the order of Mr. Antonio Uribe, of Bilbao, and under the superintendence of Captain Jose R, Bollar. She is a duplicate of a number of others which Messrs. Craig, Taylor & Co. have built, and are building, and remarkably good performances have been obtained. On leaving the ways she was gracefully christened the *Arechondo* by Miss Netta Hopper.

Bloomfield.—On September 20th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, a steel screw steamer, built to the highest class of Lloyd's on the spar-deck rules for carrying petroleum in bulk. She is of very large size amongst the vessels built for carrying oil in bulk, being 350 ft. by 50 ft. by 31 ft., and is divided into 32 separate oil-tight compartments, and in addition has six separate water-tight compartments, besides her machinery space, cross bunker, cargo hold, and pumproom. She is fitted with all the most recent improvements for her intended trade, including a double installation of powerful pumping machinery, a ventilating fan for exhausting air from the oiltight compartments, electric lighting throughout, steam winches, direct acting-steam capstans, direct-acting steam windlass with capstans, powerful steam-steering gear, and steam heating throughout. The engines, which are to be supplied by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, are of good power, having cylinders 27 in., 45 in., and 74 in. by 48 in. stroke, with three very single-ended boilers, working at 180 lbs. pressure. On leaving the ways the vessel was named the *Bloomfield* by Mrs. Brunton, of Tynemouth.

Clumberhall.—On September 21st Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, launched from their shipyard at West Hartlepool a finely modelled steel screw steamer built for the West Hartlepool Steam Navigation Co., Limited. She is of the following dimension:—Length, 352 ft.; breadth, 48 ft.; and depth, 27 ft. 9 in.; and of a measurement cargo capacity of 8,000 tons. She is of the single-deck type, with poop, bridge, and forecastle. The vessel is built to Lloyd's highest class under special survey, and capable of carrying a large cargo on a light draught. A double bottom is fitted throughout on the cellular principle for water ballast, and the after-peak is arranged as a trimming tank. She is constructed with deep frames, web frames, and longitudinal stringers, thus dispensing with hold beams, which gives clear holds for the storing of bulky cargoes. Six watertight bulkheads divide the holds into seven watertight compartments, and each hold is fitted with iron grain divisions. She also has extra large cargo hatches, and is equipped with double derricks, which have been specially designed by the firm, at each hatch, six steam winches, and is replete with all the latest improvements for rapid loading and discharging. A powerful direct steam windlass is fitted forward for the working of the cables, and steam-steering gear is fitted amidships. The saloon and captain's, and officers' accommodation is provided in a house at the fore end of the bridge, and the engineers are berthed on the bridge at the side of casings. The seamen and firemen are housed under the forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Engines of the triple-expansion type are being supplied by Messrs. Thomas Richardson & Sons, Limited, Hartlepool, with cylinders 24 in., 39 in., and 66 in. in diameter, with a stroke of 45 in., steam being supplied by two single-ended boilers constructed to work at a pressure of 160 lbs. The construction of the ship and engines has been supervised by Mr. R. Craig, owners' superintendent. As the vessel left the ways the christening ceremony was gracefully performed by Mrs. J. E. Guthe (wife of the managing director of the company), who named her *Clumberhall*.

Sheppy Allison.—On September 21st Messrs. William Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of Messrs. J. S. Allison & Co., of West Hartlepool. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 312 ft.; breadth, 43 ft.; and depth, 22 ft. $3\frac{1}{2}$ in., with full poop, bridge, and topgallant forecastle. The saloon and captain's and officers' rooms will be fitted under the poop. The hull is built with deep bulb angle frames and cellular double-bottom and aft peak tank for water ballast, four steam winches, steam-steering gear amidships, hand-screw gear aft, patent quick-warping steam windlass, two donkey boilers, grain divisions, stockless anchors, and a complete outfit will be provided for a first class cargo boat. Three cylinder triple-expansion engines of over 1,000 H.P. are being supplied by the Central Marine Engine Works of Messrs. William Gray & Co., Limited. The cylinders are 22 in., 35 in., and 59 in. diameter, with a piston stroke of 39 in., and large steel boilers having a working pressure of 160 lbs. per square inch. The construction of the ship and machinery have been under the superintendence of Captain T. Morris on behalf of the owners, and the ceremony of christening the steamer *Sheppy Allison* was gracefully performed by Mrs. Sydney Hogg, West Hartlepool. Amongst those present at the launch were: Mr. and Mrs. J. S. Allison, Mr. and Mrs. M. H. Horsley, Mr. Sydney Hogg, Mr. Cecil Hogg, Miss Daisy Hogg, Mr. John Coverdale, &c.

Ivernia.—On September 21st there was launched from the shipbuilding yard of C. S. Swan & Hunter, Limited, Wallsend-on-Tyne, a very large passenger and cargo liner, for the Cunard Steamship Co., Limited. This large steamer, which was named the *Ivernia*, is one of two sister vessels ordered by the Cunard Co. in the autumn of last year, one on the Tyne and the other on the Clyde. The *Ivernia* is intended for the company's line between Liverpool and Boston, and is designed to carry a large number of passengers. Of first and second-class passengers she will carry about 170 of the former, and about 200 of the latter. Of third-class passengers she will carry about 1,000; 500 of these are accommodated in two, four, and six-berthed staterooms. Stalls will be fitted for about 800 head of cattle and 80 horses. The leading particulars of the vessel are:—Length, overall, 600 ft.; length, between perpendiculars, 580 ft.; beam, extreme, 64 ft. 6 in.; depth, moulded to upperdeck, 41 ft. 6 in.; depth, moulded to shelter-deck, 49 ft. 6 in.; gross tonnage, about 13,900 tons; speed on trial, 16¼ knots. Her engines are being supplied by the Wallsend Slipway and Engineering Co., Limited, with an I.H.P. of 10,000; the diameters of the cylinders being 28½ in., 41 in., 58½ in., and 84 in. respectively, with a stroke of 54 in. The first two cylinders have piston valves, the two others slide valves; and the arrangement of cylinders from the forward end is somewhat unusual—high-pressure, low-pressure, first intermediate, second intermediate. Each cylinder, which has two bodies, and also double covers, is carried on two cast-iron columns of box form with separate faces, and the usual pumps are worked from the crossheads, the condenser being behind. The sole-plate is of cast-iron, and, like the columns, very massive. The propellers are three-bladed and of manganese bronze, with cast-iron bosses. There are for the ship nine boilers, all single-ended, and they are to work at 210 lbs. pressure. So big is the ship that they will all go into one boiler-room, six being placed back to back in double rows across the ship, with three boilers at the after end, so that there will be three rows and two stoking-platforms, from one of which six boilers will be fired, and from the other only three will be fired. There is a separate donkey-boiler. There will only be one funnel, but it will be 140 ft. high from the keel, and it is 15 ft. in diameter. The steam pipes are of wrought iron, lap-welded, with expansion joints. There are in the ship two of Weir's main-feed pumps and a Weir's feed-heater, two centrifugal pumps and engines of Gwynne & Co.'s make, two large Quiggin's evaporators and condensers, three of the well-known Cameron pumps, fitted for auxiliary feeding, fire, bilge, and other duty. There are four complete steel decks, lower, main, upper, and shelter; also a steel orlop deck from the boiler-room forward to the stem, and a bridge deck 280 ft. long above the shelter-deck. The space between the orlop and lower decks forward is insulated for carrying chilled beef, three large refrigerating engines being fitted in a house on the upper deck, and also a smaller one for the ship's own stores. The whole of the space forward of the engine room on the main deck is utilised for the accommodation of the third-class passengers, three rows of staterooms being fitted on each side in the three after of these compartments, the dining accommodation being between. On the same deck aft are the stalls for the cattle, which will be fitted on the latest approved principle to pass the American Cattle Regulations. On the upper deck at the forward end is a clear covered promenade for the third-class passengers, also their baths, lavatories, &c. Here also are the hospitals, surgery and bar. At the sides of the engine and boiler space, and for a short distance aft on this deck, are the berths for the engineers, crew, firemen, and stewards, and aft to the stern the stalls for the horses. At the forward end of the bridge on the shelter deck is the third-class entrance in the centre, with a ladies' room on the starboard, and a smokeroom on the port side. Continuing aft, first come the cabins for the officers, then the first class dining saloon, main stairway, pantry, galley. The remainder of the bridge is to be fitted for the second class with their dining saloon across the after end. Above the bridge deck in a large deckhouse will be accommodation for the first class, the deck over this being carried to the side for carrying the boats and for promenade. On this is a deckhouse containing the captain's rooms at the forward end, then the library, main entrance, and staircase; then at the after end the smoke room with a passage way at each side of the engine and boiler casing connecting it to the library and entrance. On top of all is the navigating bridge, wheelhouse, and charthouse. The keel was laid on December 6th of last year, and considering the difficulty the builders have had to contend with owing to the scarcity of men and the short time that the men obtainable are working, the work has been done very expeditiously, and it is expected that the *Ivernia* will take up her station on the Liverpool and Boston service early next year. On leaving the ways the vessel was named *Ivernia* by the Countess of Ravensworth.

Wearside.—On September 23rd Messrs. William Gray & Co., Limited, launched the large side ballast tank steamer, *Wearside*, which they have built to the order of Messrs. J. & E. Kish, of Sunderland. The *Wearside* is somewhat similar to the *Mancunia* and *Claudius*, the first side-tankers which were sent out by the same builders. In both these vessels when making passages in ballast, the beneficial effects of the side tanks have been very considerable, the speed and behaviour of the ships having been greatly improved, and the racing of the machinery reduced to a minimum, whilst efficient ballasting under easy control is provided without the cost and inconvenience of having to ship rubbish ballast. The *Wearside* is built to Lloyd's highest class; her dimensions are:—Length over all, 350 ft.; breadth, 51 ft.; depth, 27 ft.; deadweight capacity, 6,200 tons; with large measurement capacity and area on deck for carrying cattle or timber, &c. The arrangements throughout the ship including a special outfit of steam winches, derricks, &c., will enable cargo to be dealt with most expeditiously. A cellular double bottom extends throughout, and with a very large after peak tank contains 1,140 tons of water ballast, whilst the side tanks contain 720 tons more, or a total of 1,860 tons The side tanks (McGlashan's) extend through the main and after holds and engine room for a length of 191 ft. in way, of which the ship has double sides, adding greatly to her strength, and also to her safety. These advantages are secured without extra material being required in the construction of the side tanks, lower decks, and other parts used in strengthening ordinary ships, and which greatly impede stowage, being dispensed with, so that the new type loses nothing as a cargo carrier. The machinery consists of a fine set of triple-expansion engines of over 1,400 H.P., having cylinders 25½ in., 40½ in. and 67 in. diameter, and 45 in. piston stroke, with three main boilers to work at a pressure of 160 lbs. per square inch, all by the Central Marine Engine Works of the builders. Mr. M. Metcalfe has superintended the building of the ship on behalf of the owners, and the ceremony of christening the *Wearside* was gracefully performed by Miss Meggie Tully, of Sunderland.

Verona.—On September 23rd Messrs. Furness, Withy & Co, Limited, launched from their Middleton Shipyard, West Hartlepool, a large steel screw steamer, built to the order of Sir Christopher Furness, J.P., D.L., and she will be either disposed of or added to the Furness Line fleet. She is a fine type of a modern cargo vessel, measuring over 382 ft in length, and built throughout of Siemens-Martin steel, has a deadweight capacity of about 7,425 tons, and a cubic capacity of 409,734 cubic ft., and takes Lloyd's highest class The vessel is of the three-deck type with cargo poop, long bridge, and topgallant forecastle. All deck erections, skylights, bulwarks, &c., are constructed of steel and iron, with cellular double bottom fitted all fore-and-aft for water ballast, the after peak being also available as a tank. Permanent iron grain divisions are also fitted in connection with the ship, Eight powerful steam winches, direct steam patent windlass, combined hand and steam-steering gear worked from the bridge, stockless anchors, and all the most modern appliances are provided for the handy working of the vessel. The hatches of this vessel are of a large size to facilitate the quick manipulation of cargo. There is a fine saloon and cabin, which will be finished in polished hardwood; the crew will be berthed under the topgallant forecastle. The machinery will be supplied by Messrs. Sir Christopher Furness, Westgarth & Co,, Limited, Middlesbrough, having cylinders 25 in, 40 in., 68 in. by 48 in. stroke, steam being supplied by three single-ended boilers 13 ft. 6 in. diameter by 10 ft. 3 in. long, and 180 lbs. pressure. A large evaporator and feed heater will be fitted in connection with the engines. The vessel will be rigged as a two-masted fore-and-aft schooner.

Alpha.—Lately Messrs. Charlton & Co., Limited, launched from their shipbuilding yard at Great Grimsby a trawler, built of iron, and classed 100 A1 at Lloyd's, and of the following dimensions, viz.:—Length, 107 ft.; breadth, 21 ft.; and depth, 10 ft. 9 in. She was named the *Alpha*, by Miss Brunyee, of Hull. This being the first vessel launched since the formation of the company, special interest was manifested in the event.

Providence. — Lately Messrs. J. P. Rennoldson & Sons launched at South Shields a steel screw cargo steamer, built to the order of Mr. Fortius C. Svorono, Mariupel, for serv the Black Sea. The vessel—the dimensions of which are 225 ft. between perpendiculars, 32 ft. beam, 13 ft. moulded depth—has been built to class Div. 11 with Bureau Veritas, and to carry a deadweight of 1,050 tons on a load draught of 11 ft. This exceedingly light draught is to meet the exigences of the ports in the Sea of Azof. The engines, which are fitted by the builders, are of the triple-compound type, capable of developing 500 I.H.P., the cylinders being 15 in., 25 in. and 40 in. by 24 in. stroke, and the working pressure 160 lbs.,on the square inch. The vessel was named the *Providence*.

LAUNCHES—SCOTCH.

Marchioness.—On August 22nd the Ailsa Shipbuilding Co. launched from their shipbuilding yard at Troon a steel screw steamer, classed 100 A1 at Lloyd's, for Messrs. J. Hay & Sons, of Glasgow. The steamer is intended for the coasting and Continental trade, and is of the following dimensions:— Length, 184 ft.; breadth, 27 ft.; and depth, moulded, 13 ft. 5 in. Compound surface-condensing engines, with cylinders 21 in. and 44 in. diameter by 30 in. stroke, will be fitted by Messrs. Muir & Houston, Limited, Glasgow. The ceremony of naming the vessel the *Marchioness* was performed by the Marchioness of Ailsa.

Syriam. — On August 23rd the Grangemouth Dockyard Co. launched at Grangemouth a steel oil-tank steamer for carrying petroleum in bulk. Dimensions: — 235 ft. by 32 ft. 6 in. by 24 ft. moulded. Engines are placed aft, and the holds are subdivided into 14 oiltight compartments. The vessel will have the highest class at Lloyd's, and is provided with all the most modern machinery for a vessel of her type. Triple-expansion engines will be fitted with boilers having an arrangement for burning oil fuel, which the vessel is to use when she arrives at her destination, and with which she is expected to attain a high rate of speed. The vessel has been built to the order of Messrs. Jacobs & Barringer for clients in the East. As the vessel left the ways she was gracefully named *Syriam* by Mrs. J. T. Cargill, of Westbourne Gardens, Glasgow. This is the fifth steamer for carrying oil in bulk which the Grangemouth firm have built, and of which they make a speciality, and they have at present a duplicate vessel to the above on hand for the same owners.

Penguin.—On August 25th there was launched at Rutherglen for the Manchester and Liverpool Transport Co., Limited, Manchester, a steel steam cutter, named the *Penguin*.

Rostrevor.—On August 25th Messrs. John Fullerton & Co. launched at Paisley a steel screw steamer of about 350 tons, which has been built to the order of Messrs. Joseph Fisher & Sons, Newry, for their extensive coasting carrying trade. The steamer is largely in excess of Lloyd's requirements, and has the most modern outfit for working both ship and cargo. Compound engines of 450 I.H.P. are being supplied by Messrs. Hall-Brown, Buttery & Co., Govan. The steamer was named *Rostrevor* by Miss Bost, Adelphi House, Paisley.

Niels Ebbensen.—On August 26th there was launched at Renfrew for Forenede Dampskibs Selskab, Copenhagen, a steel schooner-rigged steamer of about 1,150 tons gross, named the *Niels Ebbensen*.

St. Blaize.—On August 26th there was launched from the Bute Slip Dock, Ardinaleish, Rothesay, a screw towing steamer, built of wood, to the order of the Mossel Bay Boating Co., Limited, South Africa. The vessel, which was named *St. Blaize*, is 66 ft. in length, 15 ft. in breadth, and 8 ft. deep. She is to be fitted with engines of 11 in. and 20 in. cylinders by Messrs White & Sons, Greenock, and is to be sailed out to her destination by Captain Alister M'Intyre, under whose superintendence she has been constructed.

Una.—On September 5th there was launched by Messrs. John Scott & Co., at Kinghorn, a finely modelled steel screw steamer, built to the order of Messrs. Bailey & Leetham, Limited, of Hull and London. The vessel has been built to Lloyd's highest class for well-deck steamers. Her dimensions are:—Length, 237 ft., between perpendiculars; breadth, moulded, 34 ft.; and depth, moulded, 17 ft. 9 in.; gross tonnage, 1,444 tons. The vessel has accommodation for 58 first-class passengers in staterooms on main deck amidships, and a large saloon and ladies' boudoir handsomely fitted up in oak in a deckhouse on bridge. Accommodation for crew is fitted forward in forecastle, and the engineers and officers are accommodated aft in poop. The captain's cabin and smoking-room and chart-house are placed immediately over main saloon, and are fitted up in style similar to saloon. She has four large hatches, and four powerful steam winches by Messrs. Roger & Co., Stockton; large steam windlass. The steam steering gear is placed at aft end of engine casing, and is by the builders, and of their latest type. The ship is rigged as a fore-and-aft schooner, and has telescopic masts. She has been fitted with electric light by Messrs. Holmes & Co., Newcastle. The machinery is also by Messrs. John Scott & Co., Kinghorn. The cylinders are 20 in., 32 in., 54 in., by 39 in. stroke, and two boilers, 14 ft. 6 in., and 11 ft long, and 180 lbs. pressure, fitted with Howden's forced draught. The interesting ceremony of launching was very gracefully performed by the Dowager Duchess of Sutherland cutting the ribbon that secured the dog-shores, and the christening was gracefully performed by Miss Blair, daughter of her grace, who gave the name *Una*. The new steamer afterwards proceeded under her own steam to Burntisland to load for her official trial. She leaves for St. Petersburg under Captain Grant after her trial trips.

Axinite.—On September 6th Messrs. A. Rodger & Co. launched at Port-Glasgow, a steel screw steamer named *Axinite* to the order of Mr. William Robertson, Glasgow. The steamer will carry 2,650 tons deadweight, and measures—Length, 260 ft; breadth, 37 ft.; depth, 19 ft. 5 in. The machinery will be supplied by Messrs. Muir & Houston, Glasgow.

Tento.—On September 6th there was launched at Aberdeen a steel steam ketch, of about 149 tons gross, named the *Tento*.

Urlana.—On September 7th Messrs. A. & J. Inglis launched at Pointhouse the second of four steamers of 8,000 tons capacity for the British India Steam Navigation Co. This vessel, which is the fiftieth built at Pointhouse for the British India Co. and its allies, was, on leaving the ways, named the *Urlana* by Miss Lily Reed, Seevis, Lee, Kent.

Aira.—On September 7th Messrs. Scott & Sons launched from their shipbuilding yard at Bowling a screw steamer of the following dimensions, viz.: 180 ft. by 30 ft. by 14 ft. moulded, which they have built to the order of Swedish owners. The vessel will be supplied with triple-expansion engines, which are to be fitted on board by Messrs. Ross & Duncan, of Govan. On moving down the ways the steamer was named *Aira* by Miss Charlotte Isobel Scott, Dunarbuck, Bowling.

Progress.—On September 7th there was launched from the yard of Messrs. Hawthorns & Co., Limited, Leith, the first of two beautifully modelled steel screw steam carriers of the following dimensions:—Length between perpendiculars, 140 ft.; breadth, moulded, 22 ft. 3 in.; depth, moulded, 11 ft. 8 in. She will be fitted out by the builders with triple-expansion engines, having cylinders 13 in., 22 in., and 37 in. diameter by 27 in. stroke, working at a boiler pressure of 200 lbs. per square inch. The hull and machinery have been constructed to the highest class at Lloyd's, and as the vessel left the ways she was named *Progress* by Miss Mary J. Leyman, daughter of the chairman of the Great Northern Steamship Fishing Co., Limited, Hull, for whom the vessel has been built.

Andrei Stempinsky.—On September 7th Messrs. William Simons & Co., Limited, Renfrew, launched complete from their yard the *Andrei Stempinsky*, a powerful barge-loading dredger for the Russian Government. This vessel has been constructed under the inspection of, and is also classed by, Bureau Veritas. Independent steam hoisting gear is provided for manipulating the bucket ladder, and also independent steam winches are fitted at bow and stern of vessel for manœuvring the vessel when at work. Electric light is fitted on deck and throughout the vessel, for working day and night. There are separate cabins for the officers and crew, and a private cabin on deck is also provided.

Atlanta.—On September 7th Messrs. Ramage & Ferguson, Limited, launched from their yard the third steam trawler they have built for Messrs. The Newhaven Trawlers, Limited. The dimensions are 105 ft. by 20 ft. 6 in. by 11 ft. 10 in. depth, moulded, and the propelling power being supplied by triple-expansion engines having cylinders 12 in., 19 in., and 30 in. diameter by 21 in. stroke, steam being supplied from a large multitubular boiler working up to 180 lbs. pressure. The christening ceremony was gracefully performed by Mrs. Walker, naming the vessel *Atlanta* as she left the ways.

Don Hugo.—On September 7th Messrs. David J. Dunlop &

Co., engineers and shipbuilders, Inch Works, Port-Glasgow, launched from their works a finely modelled steel screw steamer of the following dimensions and particulars:—Length over all, 310 ft.; breadth, moulded, 38 ft.; depth, moulded, to main deck, 20 ft. 6 in. The vessel, which is of the "well deck" type, has been built in accordance with Lloyd's rules for 100 A1 class in their registry, and also to obtain the Board of Trade passenger certificate for foreign-going steamers. Under the full poop aft accommodation is provided in state-rooms for 10 second-class passengers, entering from the raised quarter-deck through a large dining saloon, whilst ample provision is made for the comfort of those passengers, both as regards ventilation and lighting of cabins and the necessary sanitary fittings. At the fore end of quarter-deck, which extends from fore part of poop to engine-room bulkhead, a bridge-house is fitted over the main deck for a length of 128 ft., containing accommodation at the after part alongside engine and boiler casing next ship's side for officers, engineers, stewards, petty officers, pantries, &c., and a large saloon for first class passengers right across the vessel immediately forward of fiddley casing. The entrance to this saloon is from a large deck-house on bridge-deck, which is fitted up as a smoking-room in the after part, and double entrance companion at the fore part, all finished in hard wood, French polished, and the saloon is chastely finished in solid oak paneling, oak dining-tables, revolving chairs, handsome oak namelled-decorated open fireplace, with ornamental mirrors, helves, &c. The upholstery work includes sofas in rich velvet, Brussels carpet and runners, draped damask berth and window curtains, &c. The first-class state-rooms are placed along ship's side forward of dining saloon for 20 passengers, and are fitted up with the most modern requisites, including fold-up lavatories, spring mattresses, &c. From the fore part of bridge to after part of forecastle is a 40 ft. "well," the topgallant forecastle shelters the accommodation for firemen, seamen, quartermasters, lamp-rooms, store-rooms, &c.; whilst the other deck erections consist of an upper bridge, on which is placed a large teak deck-house fitted up as captain's room and chart-house; over this, again, is fitted the flying bridge, for navigation of steamer. The rig of the vessel is that of a two-masted fore-and-aft schooner, and the masts are arranged to telescope in the event of passing under canal bridges. The outfit of the steamer includes teak deck, Harfield's steam capstan windlass, Caldwell & Co.'s steam-steering gear, complete electric lighting installation by Patterson & Cooper (of Paisley), four steam winches of Clark, Chapman & Co.'s special make, pumping machinery to discharge the double bottom and peak tanks in four hours, Lord Kelvin's compass, &c. Immediately after the launch the vessel was moored in the builders' wet dock under their powerful steam derrick crane to receive her machinery, which consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 66 in. diameter by 48 in. length of stroke, steam being supplied at a working pressure of 180 lbs. per square inch by two single-ended boilers fitted with Howden's system of forced draught, auxiliary boiler for driving deck, &c., machinery. The outfit includes Weir's pumps, Mr. Dunlop's steam and pneumatic governor, evaporator, feed heater, feed filter, and bronze propeller blades. The *Don Hugo* is built to the order of the Rio Tinto Co., Limited, of London, whose agents are Messrs. Matheson & Co., of that city, and during the construction of the vessel Mr. Roberts, the owners' adviser, has been directly represented by Mr. A. J. Barrett, inspecting engineer. The new steamer will be commanded by Captain Jones. The ceremony of naming the steamer *Don Hugo* was gracefully performed by Miss Matheson, of London. Amongst the company who witnessed the launch were Mr. Keswick, the chairman of the Rio Tinto Co., Mr. McFarlane, Mr. Sartoris, and Mr. Hugh Matheson, directors. Huelva was represented by the Rev. John Jeffrey, chaplain for the company, and Mr. Anderson.

Ino.—On September 8th the Campbeltown Shipbuilding Co. launched from their yard at Trench Point a finely modelled steel screw steamer of 1,900 tons, built to the order of the Bristol Steam Navigation Co. The vessel is a sister ship to the *Cato* and *Silvio*, recently completed by the same builders for the Bristol Co. Her engines will be supplied by Messrs. Hutson & Son, Glasgow. As the vessel left the ways she was gracefully named *Ino* by Miss Morrison, Altnacraig, Greenock.

Claverdon.—On September 12th Messrs. William Hamilton & Co. launched from their Glen Yard, Port-Glasgow, a steel screw steamer for Messrs. Edmund Haslehust & Co., Billiter Buildings, London, for their general and Eastern trade. The dimensions of the vessel are as follow:—Length, between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in; with poop, long bridge amidships, and topgallant forecastle, and is classed at Lloyd's 100 A1. She is designed to carry over 5,400 tons deadweight on a light draught, with a net register tonnage of about 2,100 tons. A feature of this vessel's construction is the joggling of the shell, deck, and tank top plating, thus bringing all the strakes of plating close to the frames and beams without the use of filling slips. The propelling machinery, which is being supplied by Messrs. David Rowan & Co., of Glasgow, consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 65 in. diameter respectively by 42 in. stroke; steam is supplied by two large boilers constructed for a pressure of 180 lbs. As the vessel left the ways she was named the *Claverdon* by Mrs. Parker, wife of the captain. Immediately after the launch, which was most successful, the vessel proceeded to Glasgow to receive her machinery.

Japura.—On September 12th Messrs. Murdoch & Murray launched at Port-Glasgow the steel twin-screw steamer *Japura*, for the Amazon passenger service. The dimensions are:—Length, 140 ft.; breadth, 27 ft.; depth, 15 ft. 6 in. Messrs. Lees, Anderson & Co., Glasgow, will supply compound surface-condensing engines.

Doon and **Cairness.**—On September 16th two trawlers were launched at Aberdeen: the *Doon*, built by Messrs. J. Duthie & Sons to the order of the Deen Line of steam trawlers, Grimsby; and the *Cairness*, built by Messrs. Hall, Russell & Co., Limited, for the Fraserburgh and North of Scotland Steam Trawling Co., Limited. Both vessels are about 180 tons gross register.

Trent.—On September 19th Messrs. Robert Napier & Sons, Limited, launched at Govan the second of two steel screw steamers which they have on hand for the Royal Mail Steam Packet Co., London. The vessels have been specially designed to suit the requirements of the company's West India mail service, and as speed is an important element, they have been constructed on fine lines. They are fitted with the latest improvements for the comfort of passengers. The general dimensions are:—Length, 426 ft.; breadth, 50 ft.; depth, 35 ft.; gross tonnage, about 5,500. The vessels are built to Lloyd's highest class, under special survey, and completed in accordance with the Board of Trade regulations for passenger steamers, and also to meet the Admiralty requirements for armed cruisers. The upper decks and fittings are of teak, and the most modern appliances have been introduced for the efficient working of the ship and the rapid handling of cargo. Luxurious accommodation has been provided for a large number of first-class passengers, and all the details have been carefully considered for a service in a tropical climate. The dining saloon on the main deck is a very handsome apartment, exceptionally high, and furnished with great elegance. On the promenade deck is a reading room and ladies' boudoir, and farther aft a commodious smoking room. A feature of the passengers' accommodation is the extra large staterooms. The shade deck, on which the boats are stored, forms an admirable shelter to the spacious promenade deck, which is reserved for the first-class passengers. Very superior accommodation, scarcely inferior to the first, is provided for 40 second-class passengers. The machinery consists of a set of triple expansion engines of 7,000 I.H.P., with six single-ended steel boilers for a working pressure of 180 lbs., and supplied with the most recent improvements for efficiency and economy. The launching ceremony was performed by Miss Norton releasing, and Mrs. T. Constantine naming the ship the *Trent*.

Active and **Eclipse.**—On September 20th there were launched by the Irvine Shipbuilding and Engineering Co., Limited, at Irvine, two steel screw steam trawlers, built to the order of the Peterhead Trawling Co., Limited, Peterhead. The vessels were built to Lloyd's highest class under special survey, and are fitted with the latest appliances for fishing in the North Sea. A special feature is their large bunker capacity, which will enable them to reach the newer and more remote fishing grounds. Dimensions: 117 ft. between perpendiculars by 21 ft. by 11 ft. 9 in. moulded. The vessels are being supplied by W. V. V. Lidgerwood, of Coatbridge, with triple- [illegible] engines of about 400 I.H.P., having cylinders 12 [illegible] 32 in. in diameter by 22 in. stroke, [illegible] case from a large steel boiler [illegible] the vessels left the ways they [illegible] respectively by Miss Smith and [illegible]

Bothnia.—On September 20th there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a finely modelled steel screw steamer to the following dimensions:—Length, 230 ft.; breadth, 33 ft.; depth, moulded, to main deck, 17 ft. 3 in. She has been built to the order of the Wasa Nordsjo Angbats Aktiebolag, Finland, and is the fifth steamer which Messrs. Murdoch & Murray has built for the company. She is of the partial awning deck type, classed 100 A1. at Lloyd's, besides being exceptionally strong in the bows for working amongst ice. The saloon, captain's room, and state-rooms are in a steel house on the awning deck, surmounted by a neat chart-room and flying bridge. On leaving the ways the vessel was gracefully named *Bothnia* by Miss Maud Macfarlane, Port Glasgow. Triple-expansion engines and two boilers will be supplied by Messrs. Kincaid & Co., Greenock. During construction the vessel has been superintended by Captain W. Bergstrom, Wasa, and the machinery by Mr. G. S. Horne, Glasgow.

Ranee.—On September 20th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun the second of two large steamers they have built for the Asiatic Steam Navigation Co., of Liverpool. These vessels are built to Lloyd's highest class and to the Board of Trade requirements for a passenger certificate, and are fitted in a very superior manner to suit the special requirements of the company, and with accommodation for a limited number of first-class passengers. The dimensions are:—Length, 420 ft.; breadth, 51 ft.; depth, moulded, 32 ft. 6 in.; the deadweight carrying capacity being 8,200 tons. The engines are 26 in., 43 in. and 71 in. by 48in. stroke, and are being supplied by Messrs. Dunsmuir & Jackson, Govan. As the vessel left the ways she was named *Ranee* in the customary manner by Miss Corkhill.

Toward.—On September 20th the Caledon Shipbuilding and Engineering Co., Limited, launched at Dundee a handsome steel screw steamer of 1,250 tons gross, built to the order of the Clyde Shipping Co., Limited. The new steamer is a handsomely constructed vessel, and is intended for the company's passenger and cargo traffic between Glasgow and London. Her dimensions are as follows:—Length, 260 ft.; breadth, 35 ft.; depth, 17 ft. 3½ in. Accommodation is provided for 90 first-class passengers amidships, whilst there is ample accommodation for steerage passengers forward. In view of the large cattle trade carried on by the company, stalls have been fitted on the main deck and upper and lower holds. Her engines are of the triple-expansion type, having cylinders of 25 in., 40 in. and 65 in. respectively, with a piston stroke of 48 in. There are two single-ended cylindrical boilers, with a working pressure of 160 lbs. per square inch. A separate boiler supplies steam for the cranes and winches. There was a large attendance of spectators at the ceremony, the vessel being launched by Miss Audrey Renshaw, Barrochar. The christening ceremony was performed by Miss Renshaw, the vessel being named *Toward*.

Federica.—On September 21st Messrs. Russell & Co. launched at Port-Glasgow a steel spar-decked screw steamer of 5,800 tons deadweight for Messrs. Fratelli Cosulich, of Trieste. The steamer is of the following dimensions:—Length, 340 ft; breadth, 46 ft.; depth, 28 ft. 6 in. Machinery will be supplied by Messrs. Rankin & Blackmore, Greenock. The ceremony of naming the vessel *Federica* was performed by Miss Clapperton, Greenock.

Volcano.—On September 21st there was launched from the shipyard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, a steel paddle tug, built to the order of the British Admiralty, and intended (like the *Dromedary* and *Diligent*, also constructed by the same builders for Her Majesty's Government) for the towing of battleships and general service. With this view, she is furnished with towing gear of the strongest description. The vessel is fitted with commodious cabin, sleeping accommodation, &c., and has numerous watertight compartments. The dimensions are: 144 ft. by 27 ft. 3 in. by 15 ft. 8 in., with a gross tonnage of 411. The vessel was named the *Volcano* by Miss E. M. Trounson, Partick. After the launch the vessel proceeded to the harbour to receive her engines, which are being constructed by the builders. The machinery consists of two sets of compound oscillating paddle engines, arranged with disconnecting gear, so that each wheel has a complete pair of engines attached to it for easy manœuvring. Being intended to act as a fire vessel, she is fitted with two large double-cylinder pumping engines. The high-pressure cylinders are 31 in. diameter and the low-pressure cylinders 55 in. diameter, all having a stroke of 5 ft. Steam is supplied by two large single-ended boilers, and the whole of the main and auxiliary machinery is fitted up in the usual Admiralty style.

Hylas.—On September 21st Messrs. Archibald McMillan & Son, Limited, shipbuilders, Dumbarton, launched the steel screw steamer *Hylas*, of dimensions, 390 ft. by 48 ft. by 29 ft., with a gross register of about 4,300 tons. This vessel has been built to the order of Messrs. Raeburn & Verel, Glasgow, and has since been purchased by Messrs. R. P. Houston & Co., of Liverpool, for whom Messrs. McMillan have recently delivered two steamers for their River Plate trade, and for whom they have still in hand other two steamers, all of which are on fine lines and have good power, with a view, principally, to speedy passages. The *Hylas* is built to Lloyd's classification, and is fitted with poop, long bridge, and topgallant forecastle, and has a complete shelter deck above the main deck. All the accommodation for captain, officers, and engineers is on top of shelter deck, and the outfit is of the most complete description, with a view to the expeditious handling of ship and cargo. The christening ceremony was gracefully performed by Miss Gladys Hopkins, 3, Highfield South, Rock Ferry, Birkenhead.

LAUNCHES—Irish.

Sicilian.—On August 25th Messrs. Workman, Clark & Co., Limited, Belfast, launched from their South Yard a large steel screw steamer named the *Sicilian*, built to the order of the Allan Line Steamship Co., Limited, Glasgow. The vessel has been specially designed to meet the requirements of a passenger, cattle, and cargo boat, and is intended for the trades between Liverpool, Glasgow, and the principal Canadian ports. The *Sicilian* is of the following dimensions:—Length between perpendiculars, 430 ft.; breadth, 54 ft.; depth, moulded, 31 ft., with a gross tonnage of 5,400. She has been built under the special survey of the British Corporation of Shipping, Glasgow, and is provided with Board of Trade passenger certificate. The bottom of the vessel is framed on the cellular system for carrying water ballast, this manner of construction adding considerably to the safety of the ship. Water ballast for trimming purposes can also be carried in the forward and after peaks, and in a deep tank abaft the machinery space. Seven bulkheads extending to the upper deck subdivide the ship into eight watertight compartments, and there are three complete decks extending the entire length of vessel, with an additional tier in the forward hold. Between the upper and shelter decks and under the shelter bridge are the cattle stalls, accommodating about 600 head. The holds are arranged for the maximum stowage of cargo, and are discharged through five cargo hatches, each worked by two powerful steam winches and two derricks. Accommodation for the first-class passengers is provided on the upper bridge deck at the forward end, and will be fitted up and upholstered in the most luxurious and comfortable manner. It comprises state-rooms, lavatories, dining saloon, smokerooms, &c. The officers' and second-class rooms are placed at the after end of the bridge deck; the crew are berthed forward in the forecastle, and the cattlemen and petty officers have their quarters aft under the poop. A complete installation of electric light has been introduced throughout, including the machinery and cattle spaces. After the launch the *Sicilian* was towed to the finishing berth to receive her machinery, and will shortly be ready to take her place in the trans-Atlantic service of the Allan Line.

Persic.—On September 7th Messrs. Harland & Wolff launched from the Queen's Island Yard, Belfast, the new twin-screw steamer *Persic*—sister to the *Medic* and *Afric*—for the Australian service of the White Star Line. The dimensions of the *Persic*, like those of her predecessors, are:—Length, 550 ft. between perpendiculars, 570 ft. over all; breadth, 63 ft.; depth, 40 ft.; gross tonnage, 12,000. In her passenger accommodation, fitted for one class only, as well as regards her cargo and refrigerating appliances, she will, in all respects, resemble the *Medic* and *Afric*.

LAUNCH—German.

Itzehoe.—On Saturday, August 26th, the Flensburg Shipbuilding Co., Limited, Flensburg, launched the fifth of eight sister-ships which this firm are building for the Deutsch-Australische Dampfschiffs-Gesellschaft, of Hamburg. Her principal dimensions are:—403 ft. 8 in. by 47 ft. 8 in. by 31 ft., with a deadweight carrying capacity of about 6,500 tons. She is built to Lloyd's highest class special survey, "spar deck rule," with long poop, bridge, and forecastle. Accommodation for captain, officers, and engineers is fitted up in steel deck-houses on top of bridge, whilst the crew is housed in forecastle. These vessels are in every respect completely fitted out with all modern improvements suitable for first-class cargo boats, including a sufficient number of large steam winches, derricks, steam steering-gear, &c. The engines, which are also being constructed by this firm, will be of the triple-expansion type, having cylinders 28½ in., 47½ in., and 78 in. by 65 in. stroke, with four large boilers capable of supplying the necessary steam. As the vessel left the ways she was gracefully christened *Itzehoe* by Miss Wiengreen, the daughter of the superintendent engineer.

TRIAL TRIPS.

Tangaroa.—In July last the twin-screw steamer *Tangaroa*, built for the New Zealand passenger trade, underwent a most successful trial trip. After a pleasant cruise, the boat made two runs on the measured mile, giving an average hourly speed of about 10¾ knots. The *Tangaroa* is built of New South Wales hardwood, with deckhouse and engine room of iron. She has two sets of compound engines by M'Kie & Baxter, of Glasgow, with cylinders 11 in. and 22 in. in diameter, and a stroke of 16 in., giving 400 H.P. She has one of Thom's patent water-tube boilers of the diagonal straight-ended tube class, the first put in any Sydney-built vessel. The fan engine is one of the Challenge type, made by the engineers. The vessel's dimensions are:—Length, 108 ft.; beam, 22 ft. 10 in.; and depth, 9 ft. 8 in.

Blanche.—On August 24th the s.s. *Blanche* proceeded up the firth from Ayr to the measured mile at Skelmorlie for her trial trip. The *Blanche* is a fine screw steamer of the raised quarterdeck type, constructed in accordance with the most modern ideas for the coasting trade. She has been built by the well known firm of S. McKnight & Co., Limited, of Ayr, for Mr. William Rowland, Liverpool. The registered dimensions of the vessel are 145 ft. by 24·15 ft. by 10·05 ft., and she is capable of carrying over 400 tons of cargo on the small net register tonnage of 64 tons, whilst at the same time her capacity is such as to give her a large ratio of cubic feet per ton deadweight. The *Blanche* has been constructed in excess of the highest class at Lloyd's under their special survey, and her bottom has been extra strengthened so as to obviate any danger from grounding in port. She is fitted with powerful steam-steering gear on the bridge amidships, also steam winches, steam-warping capstan aft, and windlass for anchor gear forward. She has excellent steering capabilities, the trials in this respect showing that when going full speed she was able, with her helm hard over, to make a complete circle in about twice her own length, this being a necessity for the owner's trade when passing up canals, &c. In order that a true measure of the vessel's steaming qualities when in service might be obtained, it was arranged between the owner and builders that a loaded trial should be given. The vessel therefore received her cargo at Ayr, and on the measured mile four runs were taken at the highest speed, two with and two against the tide, when a mean speed of 11 knots was obtained. The machinery has been supplied by Messrs. Ross & Duncan, engineers, of Govan, and has also been constructed under Lloyd's rules for the highest class. It consists of a set of compound surface-condensing engines, having cylinders 18 in. and 40 in. by 27 in. stroke, supplied with steam from a large horizontal return tube marine boiler, the ample capacity of which was shown by the fact that steam was blowing off at the safety valve during the whole of the trial. The workmanship generally is of the highest class, in fact, in many respects in excess of what is usual in this type of vessel, and during the trial the machinery worked with exceeding smoothness. The owner and a large party of interested friends were on board, and expressed their satisfaction at the results attained. After completion of the speed, &c., trials, the vessel proceeded on her maiden voyage to Liverpool.

Hydra.—On August 24th the new steamer *Hydra*, built by Messrs. Wood, Skinner & Co., Limited, Bill Quay, for Messrs. Bruusgaard, Kjosterud & Co., of Dram, Norway, left the Tyne for her official trial trip. This vessel, which is a sister ship of the steamship *Hugin*, recently built by Messrs. Wood, Skinner & Co. for the same owners, is of handsome appearance, and is built on the improved single-deck type, with bridge and top-gallant forecastle, rigged as a fore-and-aft schooner with telescopic masts, and has all the latest improved appliances for facilitating the rapid loading and discharging of her cargo. The engines, which have been constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, are of their latest triple-expansion type, having cylinders 18½ in., 30 in., and 49 in. diameter by 33 in. stroke, steam being supplied by a large steam boiler working at a pressure of 160 lbs. During the trial the machinery worked with the utmost smoothness, and the performance of both the vessel and engines gave every satisfaction to all concerned. After the trial the vessel sailed under the command of Captain Gabriello. This is the fifth vessel built by Messrs. Wood, Skinner & Co., Limited, and engined by the North-Eastern Marine Engineering Co., Limited, for the same owners.

Maristow.—On August 24th the new steamer *Maristow*, built by Messrs. J. Blumer & Co., North Dock, Sunderland, for Messrs. Bellamy & Co., of Plymouth, ran her trial trip from the Wear, when a speed of 11¾ knots was obtained, everything working satisfactorily. The vessel is 341 ft. long, 46½ ft. beam, and 24½ ft. depth of hold, and will carry 5,800 tons deadweight. The engines are by Messrs. Blair & Co., Limited, of Stockton, and have cylinders 24½ in., 40 in., and 66 in. by 45 in. stroke, the boilers working at 180 lbs. pressure. The steamer afterwards proceeded under the command of Captain Prout to Newport, there to load for Rio Janeiro.

Minto.—On August 25th the new powerful ice-breaking steamer *Minto*, just completed by Messrs. Gourlay Brothers & Co., Dundee, for the Canadian Government's winter mail and passenger service between Prince Edward Island and the mainland of Canada, underwent her contract trial trip on the Tay, under the official supervision of Captain McElhinney, the Canadian Government's nautical adviser, to whose ideas she has been specially designed, and Mr. N. MacNicoll, M.I.N.A., of MacNicoll & Co., Glasgow, under whose superintendence she has been constructed. She is built to Lloyd's highest class and Board of Trade requirements—225 ft. between perpendiculars by 32 ft. 6 in. by 20 ft. 6 in., moulded, with extra heavy scantlings, &c., for cutting through the heavy ice on her route, and water ballast in cellular double bottom and in large deep tank to 'tween deck aft for giving her the proper ice-breaking trim; flush-decked, with long citadel deck-house luxuriously fitted for passengers and officers, having wheel-house and captain's room on top forward, Mason's patent pivoted side-scuttles (of large size) fitted throughout, steam-steering gear, steam windlass, steam capstan aft, McGregor's standard binnacle compass, electric light throughout and large search-light, and an armament of four 6-pounder quick-firing Hotchkiss guns to enable her to act as an auxiliary cruiser in time of war. The engines are triple-expansion, with cylinders 26 in., 41 in., and 65 in. by 39 in. stroke, two double-ended cylindrical return tubular boilers for 170 lbs. working pressure, suited for both natural and forced draught—all designed to give not less than 2,900 I.H.P., and fitted with all the latest improvements to ensure efficiency, durability, and economy in coal consumption. The speed attained was 16¼ knots, and the machinery worked smoothly and satisfactorily. The vessel, with her handsome model, fine lines, and expensive fittings, is practically a large modern steam yacht, and will be a valuable addition to the Canadian Government's fleet.

Manchester Importer.—On August 26th the *Manchester Importer*, built by Messrs. Irvines' Shipbuilding and Dry Docks Co., Limited, to the order of the Manchester Liners, Limited (of which we gave full particulars in our Launch columns, July issue, page 171), proceeded to sea for her trial trip. After the adjustment of the compasses the vessel ran the distance between Hartlepool Heugh and Souter Point lights, and then proceeded to run over the measured mile, when it was ascertained that a mean speed of 12½ knots had been attained, which was considered very satisfactory, the engines working smoothly throughout. There was a large company on board, including Alderman Southern (director and vice-chairman of the Manchester Ship Canal), Mr. W. H. Collier and Mr. H. M. Gibson (respectively manager and traffic manager of the Manchester Ship Canal), Mr. F. F. Vaughan and Mr. T. M. Greenip (respectively secretary and superintendent Manchester Liners, Limited), Mr. and Mrs. Charles Cooper, Councillor and Mrs. Lohden, Major D. G. and Mrs. Irvine, Fräulein Fredriechs, Mr. W. Allan, jun. (of William Allan & Co., Limited), Mr. H. Harrison (representing the engine builders), and Mr. A. S.

Purdon (the ship builders). The vessel proceeded to the Tyne under the command of Captain Walker, late of the *Manchester Trader*.

North Sea.—On August 26th the steel screw steamer *North Sea* (of which we gave full particulars in our Launch columns, August issue, page 234) proceeded on her trial trip in the Tees Bay, when a mean speed of 12 knots was obtained. Mr. Sanders, Mr. Wake, and Mr. Carter, who were out on the trial trip, all expressed themselves as being highly pleased with both the ship and engines. The vessel left for Archangel in the course of a few days under the command of Captain John Stephen.

Riverton.—On August 29th the s.s. *Riverton*, built by Messrs. Ropner & Son, of Stockton-on-Tees, left for her official trial trip in the Tees Bay. The steamer is built on the awning-decked rule. The saloon and cabins for the captain and officers are fitted aft, and the engineers' in iron houses on deck. She is fitted with every recent appliance for expeditious loading and unloading, and she has a full general outfit. The engines are supplied by the well-known firm of Messrs. Blair & Co., Limited, Stockton, of about 1,500 I.H.P., and she averaged 11½ knots per hour on trial. The trip was satisfactory in every respect, and, after the adjustment of compasses, she proceeded on her voyage to the U.S.A.

Tanagra.—On August 29th the steamer *Tanagra*, built for Messrs. William Thomson & Co., of St. John, New Brunswick, by Messrs. Russell & Co., Port Glasgow (for further particulars see September issue, page 285), ran her trial trip on the Clyde, making a speed of 10¼ knots, at Skelmorlie, and sailed the same evening for St. John.

Alderney.—On August 31st the fine large steel screw steamer *Alderney*, built by Messrs. William Gray & Co., Limited, West Hartlepool, was taken to sea for her trial trip. Her owners are Messrs. A. N. Hansen & Co., of Copenhagen, for whom Messrs. Gray have previously built a couple of steamers of similar capacity. The vessel takes Lloyd's highest class, and is of the following dimensions:—Length, over all, 336 ft.; breadth, 48 ft. 6 in.; depth, 24 ft. Triple-expansion engines having cylinders 24 in., 38 in., and 64 in. in diameter, with a piston stroke of 42 in., and large steel boilers working at a pressure of 160 lbs. per square inch, have been supplied from the Central Marine Engine Works of William Gray & Co. The trial was highly satisfactory, a mean speed of 12 knots being maintained. The vessel (which was in ballast trim), after disembarking her visitors, proceeded on her voyage to St. John's, Newfoundland.

Mabel Grace.—On September 2nd the paddle-steamer *Mabel Grace*, built and engined by Messrs: Laird Brothers, Birkenhead (of which we gave particulars in our Launch columns, April issue, page 40), underwent her official trials on the Clyde with satisfactory results, a mean speed of 20·23 knots being attained on six consecutive runs on the measured mile.

Bernicia.—On September 5th the new steamer, *Bernicia*, built by Messrs. R. Craggs & Sons, Middlesbrough, to the order of Messrs. J. E. Bowsher & Sons, Newcastle-on-Tyne, and engined by the North-Eastern Marine Engineering Co., Limited, Wallsend-on Tyne, left the Tees for her official trial trip. The vessel is of handsome design, her principal dimensions being as follow:—Length, 350 ft.; breadth, 47 ft.; and depth, moulded, 26 ft. 7 in., and with a cargo capacity of 5,850 tons; her loaded draught is 21 ft. ½ in: She is built to Lloyd's highest class, and is of the improved single-deck type. The propelling machinery, which has been constructed at the Wallsend works of the North-Eastern Marine Engineering Co., Limited, consists of a set of their latest type of triple-expansion engines, having cylinders 25 in., 41 in., and 67 in. in diameter, by 45 in. stroke, and two large single-ended steel boilers, working at a pressure of 160 lbs. The trial of both ship and machinery proved in every way satisfactory, a mean speed of 11¾ knots being attained.

Star of Australia.—On September 7th this steel screw steamer proceeded down the river to Belfast Lough on her trial trip, having on board a party representing the owners and builders and accompanied by some friends. This vessel is the fifth built by Messrs. Workman, Clark & Co., Limited, for Messrs. J. P. Corry & Co., of London, and is of the following dimensions:—Length, 440 ft.; breadth, 55 ft.; depth moulded, 33 ft.; with a gross tonnage of 7,198. She has been constructed under special survey to class 100 A 1 at Lloyd's, and to the Board of Trade requirements for a first-class cargo steamer. There are three complete decks extending from stem to stern, and seven watertight bulkheads dividing the vessel into eight separate compartments, viz., five cargo holds, machinery spaces, and two peaks. Water ballast is carried in the after peak and in a double bottom, which extends the entire lengths of holds and machinery spaces. As the *Star of Australia* will be chiefly engaged in Messrs. Tyser & Co.'s frozen meat trade to Australia and New Zealand, the forward holds and 'tween decks have been insulated, and are capable of stowing over 100,000 sheep's carcases. The refrigerating machine, by Mr. Benjamin Goodfellow, is a duplex tandem, putting through 240,000 cubic feet per hour, and is considerably the largest cold-air machine yet fitted on board any vessel. Accommodation is provided in a bridge house amidships, forward of the boiler casings, for the captain and officers, and round the engine casings, convenient to their work, are the engineers' staterooms, the crew being comfortably berthed forward on the upper deck. The vessel is rigged as a brigantine, the fore lower mast and yard being of steel. The deck machinery and cargo gear have been arranged for the minimum waste of time in the discharge of cargo, and for easy handling of the vessel; it embraces ten derricks worked by ten powerful steam winches, steam and screw steering gears, and a patent windlass, all by the best makers. The engines are of the triple-expansion type, supplied with steam at a pressure of 200 lbs. from four large steel boilers. The speed trials proved highly satisfactory. In the evening the *Star of Australia* left the lough for London, to load for her maiden voyage and proceed in command of Captain John Simpson, commodore of the Star fleet.

Rowena.—On September 8th the large steel screw steamer *Rowena* was sent to sea by Messrs. William Gray & Co., Limited, for her trial trip. She has been built to the order of Messrs. Herskind & Co., of West Hartlepool (of which we gave full particulars in our Launch columns, July issue, page 173). There was no hitch or trouble, the trial being in every way satisfactory. The vessel proceeded to the Tyne to load for Genoa.

Una.—On September 9th the steel screw steamer *Una*, launched on September 5th (of which we give full particulars in our Launch columns) from the shipbuilding and engineering works of Messrs. John Scott & Co., Kinghorn, went on her official trial trip. The engines worked smoothly during the trial, and the vessel attained a mean speed of about 14 knots over the measured mile, which is very creditable to Mr. Weir, the engineering manager of Messrs. John Scott & Co. There was a large company of ladies and gentlemen on board during the trial, including the Duchess Dowager of Sutherland. The *Una* returned to Burntisland after the trial, where she will coal prior to leaving for London.

Balakani.—On September 9th this vessel, built to the order of Messrs. Lane & Macandrew, of London, by Messrs. Sir James Laing & Sons, Limited, of Sunderland (of which we gave full particulars in our Launch columns, September issue, page 282), was taken for trial at sea, when the average speed attained was over 10½ knots, the machinery and boilers, built by Messrs. George Clark, of Sunderland, working satisfactorily. The vessel returned to Sunderland to coal for her voyage.

Avondale.—On September 11th the screw steamer *Avondale* recently launched from the shipbuilding yard of Messrs. Short Brothers, Sunderland, to the order of Messrs. G. H. Elder & Co., of Newcastle-on-Tyne (of which we gave full particulars in our Launch columns, September issue, page 282), went out on trial with very satisfactory results. After adjusting compasses the vessel was taken a series of runs over the measured mile, when a mean speed of 10½ knots was attained. After the trial the vessel proceeded to Archangel under the command of Captain Fothergill.

Philippeville.—On September 11th the fine twin-screw mail and passenger steamer *Philippeville*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, to the order of Messrs. Elder, Dempster & Co., of Liverpool, for the Société Maritime du Congo, proceeded to sea for her official trials under the command of Captain Meinertz. This vessel is intended to run in the Belgian mail line between Antwerp and the Congo, and is similar to the *Anversville*, lately built by Sir Raylton Dixon & Co., for the same trade. Her dimensions are: 382 ft. by 46 ft. by 25 ft. moulded. Accommodation is provided in most spacious and handsomely fitted cabins for 108 first-class and 70 second-class passengers, with large dining-room in house on deck panelled in marble and inlaid wood. The first-class smoking-room, second-class smoking-room and cabin entrances are elaborately fitted and decorated, and the vessel is lighted throughout with electric light. A powerful refrigerating machine with large cooling chambers is also provided for the conveyance of fresh meat, provisions, &c. Twin-screw triple-expansion engines have been fitted by the Wallsend Slipway and Engineering Co., Limited, Newcastle-on-Tyne, having cylinders 21½ in., 34 in., 59 in. by 42 in. stroke, supplied with steam by four large single-ended boilers working at 180 lbs. pressure, and fitted with Howden's system of forced draught. The hull and engines have been built under the supervision of Mr. Butterworth. A number of friends were on board during the trial trip, which passed off most successfully. This is the sixth vessel built by Sir Raylton Dixon & Co., Limited for this service, and another is now in course of construction.

Robert Irvine.—On September 12th the s.s. *Robert Irvine*, built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, for Messrs. Robert Irvine & Co., Tower Chambers, West Hartlepool (of which we gave full particulars in our Launch columns, September issue, page 281), proceeded on her trial trip. After the compasses had been adjusted the vessel proceeded at full speed, and on completion of the trial it was ascertained a mean speed of 12 knots had been attained, which was considered very satisfactory, the engines working smoothly. The owners were represented by Mr. C. Clark, marine superintendent, the shipbuilders by Major D. G. Irvine and Mr. A. S. Purdon, and the engine builders by Mr. Urquhart.

Montezuma.—On September 12th the twin-screw steamer *Montezuma*, built by Messrs. Alexander Stephen & Sons, Linthouse, for Messrs. Elder, Dempster & Co., Liverpool, made her official trial trip in the Firth of Clyde with results that were all that could be desired; and Mr. Ward, who represented the owners on the occasion, expressed his satisfaction with the exceedingly successful trial. A mean speed of 13·16 knots was maintained. The *Montezuma* is classed 100 A1 three-deck rule in Lloyd's, and is considerably in excess of their requirements. She is 500 ft. long over all, and her measurement capacity is about 20,000 tons. She has sailed for New Orleans, and is expected to load the largest cotton cargo ever taken from a cotton port. Besides two complete decks with lofty space between, she has a shelter deck all fore and aft, and an upper bridge. The shelter and upper bridge spaces are arranged to carry cattle when desired, an excellent water service being provided. The saloon, staterooms, and accommodation for officers and engineers are on top of upper bridge. Water ballast up to about 3,600 tons can be carried. Tanks are also set apart for carrying fresh water for cattle or boilers, and these can be replenished by condensers of ample power. The vessel is rigged with four pole masts, and presents a very fine appearance. All her working appliances are modern and effective. Her engines embrace two sets of cylinders 22½ in., 36 in., and 61 in. diameter by 48 in. stroke, and three boilers 15 ft. 7 in. by 12 ft., working at 180 lbs. pressure, and fitted with Howden's forced draught. The propeller blades are of manganese bronze. She has 13 large steam winches by Lynn & Co., and her auxiliaries include two Weir's feed pumps with feed heater, two Drysdale's centrifugal pumps, two Carruthers's ballast pumps, Quiggin's combined evaporator and winch-exhaust condenser, Quiggin's feed filter, Alley & McLellan's ash-hoisting engine, &c. A complete installation of electric light, by Allen, is fitted throughout the vessel.

Ferndene.—On September 12th the screw steamer *Ferndene*, built by the Northumberland Shipbuilding Co., Limited, Howdon, for the Dene Steam Shipping Co., Limited (of which we gave full particulars in our Launch columns, August issue, page 234), was taken to sea for her trial trip over the measured mile off Whitley, with satisfaction to all concerned, a mean speed of about 12 knots an hour being attained, notwithstanding that the steamer was in ballast trim. The steamer proceeded on her maiden voyage to Philadelphia, under the command of Captain John Jones.

Lucifer.—On September 16th the s.s. *Lucifer*, which has been built to the order of the Bear Creek Oil and Shipping Co., Limited, of Liverpool, of which company Messrs. C. T. Bowring & Co. are the managers, by C. S. Swan & Hunter, Limited (of which we gave full particulars in our Launch columns, September issue, page 282), was taken out to sea on her trial trip, when everything worked smoothly, and the vessel made a mean speed of 10 knots on the measured mile, and afterwards proceeded on her first voyage to Philadelphia.

Lynton.—On September 16th the new steamer *Lynton* left the South Dock for a series of runs over the measured mile. She is a fine screw steamer, specially designed for the cargo and cattle trade, and built by Messrs. Robert Thompson & Sons, Southwick Yard, to the order of the Liverpool Shipping Co., Limited, of Liverpool, of which Messrs. Johnstone, Sproule & Co. are the managing owners (for further particulars see September issue, page 282). After a succession of runs over the measured mile, a mean speed of 11 knots was attained. Amongst those present were Mr. Sproule, the managing owner, and Mr. Sinclair, consulting engineer, who expressed themselves highly satisfied with the results of the trial, the engines working smoothly and without the slightest hitch.

Neto.—On September 16th the *Neto*, belonging to Messrs. Strong, Reid & Page, went on her trial trip. She was in light trim, and some little difficulty was experienced in getting her head round, but after the *Nelson's* tow rope had carried away twice, the steamer was headed for sea, favoured a little by a somewhat sluggish ebb tide, but in the teeth of half a gale. Under these circumstances her performance of passing the measured mile at a speed of just under 10 knots was considered to be very good, and a distinct improvement on any previous performance. She had been in the hands of Messrs. D. Rollo & Sons, Fulton Engine Works, Liverpool, for some time back, having her engines altered to the high-pressure compound system, and being fitted with a new boiler of 200 lbs. pressure, under Howden's system of forced draught. The new engines have cylinders of 20 in. and 50 in. diameter, with a stroke of 36 in., boiler-heating surface of 1,720 sq. ft. The old boilers were two in number, carrying a pressure of 90 lbs. By the conversion a considerable bunker saving has been effected, and a saving of space generally, as in the case of one boiler the coal can be carried on both sides. Whilst the vessel was lying up during these alterations advantage was taken to renew the deck, and to bring the hull generally up to date. The double bottom tanks in the machinery space were renewed, whilst the machinery, to get the full benefit of the higher pressure, has been fitted with all the latest improvements. By the substitution of the single boiler economy of coal and of stores has been secured. A steam feed-heater and evaporator and feed filter have been supplied. The work has been carried out under the direction of Messrs. George Hepburn & Son, the company's superintending engineers, and has been under the personal supervision of Captain Brown and Mr. J. B. Hepburn, the company's marine overlooker and superintending engineer. On her trial the working of the engines gave every satisfaction, and in every respect fully answered expectations.

Commander Cawley.—On September 19th the Humber Pilots' new steamer went for her trial trip off the Tyne. The vessel, which is named the *Commander Cawley*, in compliment to the president of the United Kingdom Pilot Association, has been built by Messrs. J. T. Eltringham & Co., South Shields. The dimensions are as follow:—Length over all, 129 ft.; breadth, 23 ft.; depth, 11 ft. 6 in. She takes Lloyd's highest class as a steam yacht. The design embodies all the most modern devices for the efficient working of a steam pilot vessel. She is fitted with extra large rolling chocks and special arrangements for getting out the boarding boats by machinery. The saloon provides sleeping accommodation for 24 pilots. The vessel is heated by steam and lighted by electricity throughout. A powerful cluster light is arranged to facilitate the working of the boarding boats at night, and the signal lights are all controlled from the captain's cabin. Triple-expansion engines are fitted by Mr. G. T. Grey, having cylinders 12¼ in., 19½ in., and 32 in., with 22½ in. stroke, and the auxiliary machinery includes a centrifugal pump for working the condenser when the main engines are not running. A speed of 10½ knots was easily maintained during the trial.

Clan Macfadyen.—On September 21st the screw steamer *Clan Macfadyen*, built and engined by Messrs. Blackwood & Gordon, Port-Glasgow, for the Clan Line Steamers Co., of whom Messrs. Cayzer, Irvine & Co., of Glasgow, are the managers (of which we gave particulars in our Launch columns, September issue, page 284), went down the firth on her official trial trip. The day was rather unfavourable for testing the speed, but notwithstanding this a speed of fully 13¼ knots was attained, which was considered highly satisfactory. The steamer proceeds to Glasgow, where she will load for the East Indies. The company were represented on the trial trip by Mr. John Lyall, the superintending engineer, who has supervised the building of the steamer.

British Princess.—Lately the finely modelled steel twin-screw steamer *British Princess*, built by Palmer's Shipbuilding and Iron

Co., Limited, Jarrow-on-Tyne (of which we gave full particulars in our Launch columns, August issue, page 235), was taken out to sea for her official steam trials, during which the engines worked in a highly satisfactory manner at 76 revolutions per minute, and a mean speed of 13·24 knots was attained on the measured mile. The vessel has been built to the order of the British Shipowners' Co., Liverpool.

Dredgers.—The two powerful twin-screw dredging vessels, launched by William Simons & Co., Limited, of Renfrew, for Talienwan, have completed their dredging and steaming trials with very satisfactory results. During the dredging trials, when running 18 buckets per minute, 1,050 tons of ordinary free soil were raised per hour, and when running 12 buckets per minute in harder material 450 tons of spoil were raised per hour, both results being considerably in excess of the contract requirements. The centrifugal discharge pumps on their trials dealt with and discharged on shore through their respective lengths of steel piping the full amount of dredgings raised up by the buckets. The sand suction pumps, working on a maximum depth of 40 ft., are each capable of raising at least 1,000 tons of sand per hour. During a two-hours' run on the measured mile with and against the tide a mean speed of over eight knots was obtained, being fully one knot in excess of the speed stipulated in the contract. The owners were represented at the trials by Messrs. Totshyski, Gooseff, Johnson, and Lees. The vessels were being prepared for the voyage under steam and sail to North China, to be despatched on an early date.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class; 2C Second Class.

August 26th, 1899.

Betz, Antoine T.	2C	London
Brown, Harry..	2C	N.Shields
Bruce, B. J. E.	2C	Hull
Bruce, Thomas	1C	London
Burton, John S.	2C	Aberdeen
Carey, Hugh ..	2C	London
Christie, Henry	2C	N.Shields
Dobson, John ..	1C	,,
Dove, Arthur ..	2C	Aberdeen
Fife, James	1C	London
Ford, Wm.	1C	Aberdeen
Gardyne, Arthur	1C	London
Golightly, W. S.	2C	Sundrlnd
Harwood, L....	1C	Liverpool
Henderson, J. S.	2C	,,
Johnson, E.....	1C	London
Jones, J. M'K...	1C	Liverpool
Leech, John B.	1C	London
Mace, Francis R.	2C	,,
Phillips, Edward	2C	N.Shields
Porter, M. W. ..	1C	Hull
Rawlinson, J. F.	2C	Liverpool
Robertson, R. G.	1C	Aberdeen
Robson, T. J. ..	2C	Sundrlnd
Ross, Andrew P.	1C	Liverpool
Taylor, Adam L.	2C	Aberdeen
Tweedie, Alex.S.	2C	Liverpool
Walton, James.	2C	,,
Wilkinson, R...	1C	Sundrlnd

September 2nd.

Anderton, Henry	2C	Liverpool
Baxter, James..	2C	Glasgow
Boyes, Richard	1C	N.Shields
Braidwood, A.G.	2C	London
Brand, Samuel	2C	Liverpool
Buchanan J. C.	2C	Glasgow
Cameron, D. W.	1C	,,
Cowan, John ..	1C	,,
Edwards, Robt.	2C	Liverpool
Evans, Asa J. ..	2C	Cardiff
Giles, Arthur W.	1C	,,
Gilroy, Edward	1C	Glasgow
Griffiths, T. O.	2C	Cardiff
Heathcote, H. A.	2C	Sthmptn
Hendry, Wm. ..	2C	Glasgow
Hurst, Jas. R...	2C	Liverpool
Kerr, Robt. J...	1C	Belfast
MacLean, Mdch	1C	Glasgow
M'Ferran, T. E.	2C	Cardiff
Murray, Wm. ..	2C	Glasgow
Parkin, T. M. ..	1C	N.Shields
Patterson, F. H.	2C	Cardiff
Phillips, Fred. J.	1C	,,
Raeburn, R. B.	1C	London
Randall, H. G.T.	2C	,,
Rowland, Wm..	1C	Cardiff
Rutter, G. W..	1C	Liverpool
Scott, Alex.	2C	Glasgow
Sharpe, Thos. ..	2C	,,
Sim, John......	1C	,,
Smith, F.R.A.E.	2C	London
Smith, Harry J.	2C	Sthmpton
Stericker, John	1C	London
Stout, C. H.	2C	Liverpool
Tasker, W. D...	2C	Glasgow
Thomson, J. H.	1C	London
Velge, G. C. H.	1C	,,
West, Edgar L.	1C	Falmouth
Wilkie, David C.	2C	Liverpool

September 9th.

Anderson, W. ..	2C	N.Shields
Beckett, W. M.	2C	Liverpool
Campbell, Fred.	2C	London
Coates, Arthur..	2C	N.Shields
Coutts, Jas.	1C	Liverpool
Croker, J. H. ..	1C	,,
Evans, J. J. G..	2C	London
Hill, Percy J. ..	1C	,,
Humphreys, K H	2C	Liverpool
Kitchen, Wm...	2C	,,
Lyon, Wm. H.	1C	,,
M'Clung, T. G.	2C	London
Smith, Joseph..	2C	N.Shields
Stenner, T. S...	1C	London
Still, Alexr.	2C	N.Shields
Stoddart	1C	,,
Swan, Arthur F.	1C	Liverpool
Thompson, H.E.	1C	,,
Waterfield, T. ..	2C	

September 16th.

Barclay, Robt..	1C	Greenock
Beath, James..	2C	Hull
Clark, George ..	2C	N.Shields
Dann, Tom E...	2C	Hull
Filshie, William	2C	Leith
Forbes, Andrew	1C	,,
Graham, Jas. ..	1C	Greenock
Gruzelier, S. ..	2C	Plymth
Gwynne, J. W.	2C	Liverpool
Healy, Wm.....	2C	Greenock
Hudson, Rhodes	2C	Hull
Hutchinson, F.M	2C	N.Shields
Joyner, Albert L.	1C	London
Kennedy, W. M.	2C	N.Shields
Legg, Peter	1C	,,
Martin, John ..	1C	Greenock
Melrose, John ..	2C	,,
M'Kinlay, Jas.S.	2C	,,
M'Millan, John	2C	,,
Moore, John R.	1C	Liverpool
M'Rae, Neil	1C	Greenock
Pullar, Thos. ..	2C	,,
Richards, Thos.	2C	Liverpool
Scullard, Harry	1C	N.Shields
Smith, Wm. A.	1C	Greenock
Spence, Archbld.	2C	N.Shields
Steeves, A. G...	1C	Liverpool
Stuart, Chas. R.	2C	London
Taylor, Stanley	2C	Liverpool
Taylor, Wilfrid	1C	Hull
Thomson, A. L.	2C	Greenock
Watt, John D.	2C	,,
Wilson, Allan M.	2C	,,
Yellowlees, D...	1C	,,
Young, Wm.....	2C	NShields

September 23rd.

Barton, George	2C	Glasgow
Best, Wm. J. ..	2C	WHrtlepl
Brack, Benj....	1C	,,
Campbell, D. ..	2C	Glasgow
Campbell, R. H.	2C	,,
Clark, Edward	2C	,,
Clarke, John H.	2C	Liverpool
Cleland, T. W..	2C	Glasgow
Crawford, D. C.	1C	Liverpool
Dakers, J. E. S.	2C	Cardiff
Darch, Ernest..	1C	Liverpool
Docherty, Dan.	1C	Glasgow
Dunsmore, Jas.	1C	London
Edmunds, Noah	2C	Cardiff
Evans, Chas. A.	2C	,,
Evenden, P. W.	2C	Liverpool
Eynon, Jas. A..	1C	Cardiff
Foggitt, Joseph	2C	WHrtlepl
Geddes, Alexr..	1C	Dundee
Gifford, Jas. W.	2C	N.Shields
Graham, Alexr.	2C	Glasgow
Harper, H.	1C	Liverpool
Hiskett, W. A..	2C	Cardiff
Holman, Jas. N.	1C	WHrtlepl
Jenkins, Wm...	1C	Liverpool
Johnson, Ernest	1C	Bristol
Johnson, L. J..	1C	N.Shields
Leng, Percy D..	1C	WHrtlepl
Longford, J. J.	2C	Cardiff
Ludbrook, S. A.	2C	WHrtlepl
Luff, B. G.	1C	Cardiff
Martin, David ..	1C	Dundee
M'Laren, R. B.	1C	Glasgow
M'Nicol, John..	1C	,,
Morris, Wm. ..	1C	Cardiff
Pool, Thos.	2C	,,
Reid, Geo......	1C	,,
Robinson, G. L.	1C	N.Shields
Scott, David ..	1C	WHrtlepl
Scott, R. A.....	2C	Glasgow
Shaw, Edwin ..	2C	WHrtlepl
Smart, Wm. H.	1C	Glasgow
Spencer, A. E.	1C	Liverpool
Sumner, Jas. ..	1C	London
Thomson, R. G.	2C	Glasgow
Walker, A. A...	2C	Liverpool
Warren, E. J. ..	2C	Bristol
Whitehouse, J.H.	2C	Sthmptn
Wills, Chas. F..	2C	N.Shields
Wright, Peter..	2C	Glasgow
Wylie, Jas.	2C	,,

The Missions to Seamen.—We have received from the Rev. T. S. Hatfield, the association's secretary, at Harrogate, an advance proof of the Churchman's Almanack for 1900, which contains a calendar of events connected with the sea, ships, and sailors. This compilation contains, besides the calendar, leaves for memoranda for every day of the year, and a lot of information of an interesting character connected with the society. It is estimated that our seafaring population is over 600,000, and to minister to this large number the society employs 190 chaplains, readers, &c., working in 69 home and foreign ports, furnished with 69 mission vessels, and 91 seamen's churches and institutes. In 1898 over 900,000 publications were placed on board ships, and about 44,326 boxes, bags, or parcels of reading matter sent to sea, whilst 6,073 sailors enrolled as total abstainers. In 1898 the income of the society was £43,284, a sum, however, quite inadequate to meet he urgent calls for help.

Messrs. T. Richardson & Sons, Limited.—We have received a catalogue just issued by this firm relative to the lockfast iron shafts which are one of their specialities of manufacture. This publication contains a most interesting description of the manufacture of propeller shafts, both in the usual manner and that adopted by the above firm in making these lockfast shafts. The reasons to which the fracture of shafts is attributed are fully explained, and the manner in which the difficulties can be overcome is set forth. The catalogue is beautifully illustrated with views of the works and specimens illustrative of the descriptive matter. A sheet also accompanies it illustrating Morison's surface feed-heater. Both are magnificent specimens of colour-printing, and the letterpress of the catalogue is up to the best style of printing.

For want of space we are obliged to hold over our Patent List, Reviews, &c.—ED. M.E

HE NEW YORK
BLIC LIBRARY
ASTOR, LENOX AND
ILDEN FOUNDATIONS.

The Marine Engineer.

LONDON, NOVEMBER 1, 1899.

IN former issues we have stated that in our opinion any further increase of speed, and even the present record speeds of the trans-Atlantic service, with its increased cost due to such excessive speeds, could only be made commercially payable by separating the high-priced first-class passenger service from the mass of the cheaper passenger and goods traffic. We see that the Hamburg-American Company are about to test this theory by providing a yacht 400 ft. long, fitted for carrying first-class passengers only. The new essay is, however, we believe, to be made only in trips to Norway, the Mediterranean, and the Orient; and, if successful, the owners propose to build other vessels on the same lines, and with even faster speeds than that of the present vessel, which it is said is not to exceed 16 knots. The accommodation for passengers is proposed to be on a most fastidious scale of luxury. Each passenger is to have a separate stateroom to himself, and, for those who are willing to pay, complete suites of chambers with separate bathrooms are to be provided. As those who desire especially high-speed travelling accompanied with every obtainable comfort and luxury, and who are well able and willing to pay high prices for such accommodation, are on the increase year by year, we are strongly of opinion that such a venture will pay provided the first-class passenger vessels are of sufficient tonnage to be safe and comfortable.

WE are glad to see that the Belfast Harbour Commissioners have apparently at last realised the probable harm, from an industrial point of view, that they would have done to their city, had they persisted in their arrangements so as to prevent Messrs. Harland & Wolff from extending their works to meet increased trade by the acquisition of adjoining land. Such obstructive policy might have resulted in the driving away both from Belfast and Ireland of one of the most magnificent industries of modern times, and one which, whilst located at Belfast, reflects the greatest honour upon both the town and country, besides bringing most material support in wages to the welfare of the town and population. It would appear that the proposed works in the harbour relating to a new cut, or channel, in the county Down side of the harbour, and to a new tidal dock at the south-westward termination of the said cut, can be carried out without crippling the desired extension of Messrs. Harland & Wolff's yards and slips; and, if so, it would be a pity if the Commissioners could not see their way both to carry out their own proposed works and yet to admit of such extension of Messrs. Harland & Wolff's yards as may serve still further to prolong and rivet the connection of that firm with the city of Belfast. We see that at last, after much obstinacy on the part of the Commissioners, the matter has been referred to the chairman, Sir James Musgrave, to consult with the firm as to the ground wanted, and that power has been given him to adjust a friendly settlement. This looks as if the matter was now going to be considered in a friendly light, and should quickly bring about a satisfactory settlement.

THE disaster to the engines of the *Bullfinch*, which was occasioned by the breaking down of a connecting rod, has caused considerable attention to be given to those in use, which were of steel, and of course as of light dimensions as the designer dare use. The general design of this rod, with its crutch or fork end, was a very usual one, and would not appear to give rise to any criticism as to strength from its appearance to the eye, which is so often the gauge as to strength with practical engineers. The large size, however, of the crank and crosshead pins, relatively to a short rod in such high-speed engines with great steam pressures, causes the spread of the fork, or crutch (estimated from centre to centre of the crosshead bolts), to be excessive compared with the diameter of the body of the connecting rod. In ordinary connecting rods the crosshead or big ends have so little swell beyond the adjoining body of the rod that any vertical strains or stresses upon the fork ends may be almost considered to be shearing strains relatively to the body of the rod. In the type of rod, however, used in the *Bullfinch*, and in many rods of similar classes of engines, the overhanging wings of the fork may be considered as cantilevers on either side of the body end of the rod. In such cases the transverse breaking moment due to the longitudinal pull or thrust of the crosshead bolts may be multiplied as many times as stress per square inch on the arms of the fork close to the end of the rod, as compared with the direct tensional or compressional stress in the body of the rod or in the crosshead bolts. If the depth of the crutch cantilever close to the body of the rod is only 2⅜ in., whilst the bending moment of the cantilever is 5⅛ in. from the line of the crosshead bolt to the centre of the rod, it is obvious that the longitudinal pull or thrust of the crosshead bolt may be multiplied about four times upon approximately half the section of the fork, and this may be more than sufficient to stress the metal beyond its limit of elasticity, and thus sooner or later to break it. The lower parts of the fork, or crutch, of such connecting where the spread is wide enough to convert them into cantilevers, should be thickened or deepened as they join the body of the rod, as would be the case in a properly designed cantilever.

THE near completion of the two new U.S. battleships, *Kearsage* and *Kentucky*, which are nearly ready for their trial trips, have drawn considerable attention to these latest products of the American constructors' skill. The greatest novelty in the construction of these vessels, viz., superimposed turrets containing 8-in. guns, above the lower turrets carrying 13-in. guns, has been the cause of the greatest diversity of opinion as to their possible usefulness. Each pair of turrets, carrying two 13-in. guns in the basement, and two 8-in. guns on the first floor, has only a single turning gear. Any disablement of this turning gear will thus put all four guns out of action. The 8- and 13-in. guns must also be loaded, pointed, and fired simultaneously, and it is difficult to imagine that all operations can be carried on so simultaneously that one gun will not have to wait for the other. The higher elevation also of the upper turret will give the recoil of its gun immense leverage to break away the relative fastenings of one turret to the other. It is not an improbability that this might serve entirely to disrupt the upper turret; and the addition of the shock of the recoil of the upper gun at such an extreme leverage, or moment, from the base of the main turret, when occurring at the same time as the recoil shock of the heavier gun in the lower turret, might even serve to disorganise the attachments or the turning gear of both. We understand that the upper turrets are but experimental, and are fitted so as to be easily removed; but, if so, can the loss of armament and the loss of weight so removed be utilised elsewhere in the vessels, which were originally designed for the specific armament of the vessels as they are now designed. It is well known that our American cousins are the most inventive people upon earth, but we trust that their craze for novelties will not lead them too far away from tried and acknowledged types of vessels in their new Navy armaments, as some day we may see them arrayed with our own battleships for the maintenance of liberty and unfettered commerce.

SOME NOTES ON THE APPLICATION OF ELECTRICITY IN SHIPBUILDING YARDS.

By SHERARD COWPER-COLES.

Electric Drilling Machines.

ONE of the most useful applications of electro-motors is for drilling machines, which are now being extensively used in all classes of engineering shops, especially shipbuilding yards, which must necessarily extend over a considerable area, and contain many points remote from one another where a drilling machine is required. The efficiency of a well designed motor is about 80 per cent.; provided the conductors are of sufficient size, 70 per cent. of the power applied can safely be relied upon in the case of electrical transmission in shops.

At the works of Messrs. Siemens Bros., at Charlton, where a continuous current is used, 5 per cent. less is found to occur in the conductors, and 10 per cent. less in conversion from electrical into mechanical energy, the cost per brake power being 1·71d.

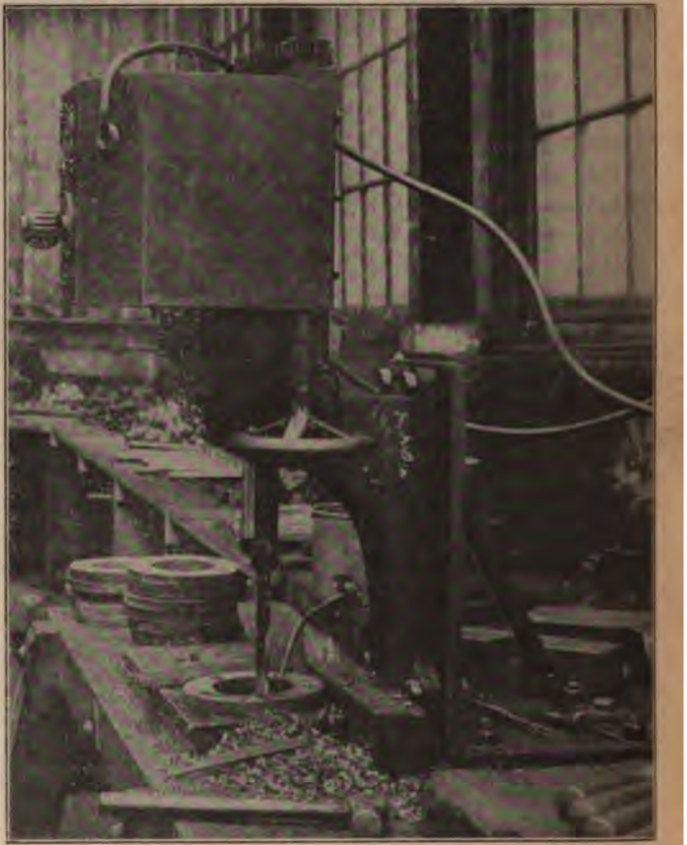


Fig. 1.

The repairs on a good enclosed motor, when carefully inspected at frequent intervals by a competent man, are very small indeed. Fig. 1 illustrates an electric drilling machine as adapted for bench work, and is suitable for pipe flanges and other small bodies. The use of this machine has also been suggested for the drilling of electric rails for bonding whilst being laid. Fig. 2 is a portable machine adapted especially for awkward work—not only does the carriage on which it is mounted provide the maximum portability, but the motor itself is swung on trunnions so as to work at any angle: this machine is also suitable for the sinking of key-ways in large propeller and crank shafts, which has always been a slow operation, but by using an electric drill, a series of holes can be rapidly drilled and the intervening metal easily removed. Fig. 3 illustrates a machine which is coming into favour as a portable drilling tool. As a rule it is provided with a telescopic shaft instead of a lexible shaft, and change wheels to alter the speed of he machine, so that it can be used for a large range f work. Fig. 4 represents an electric drilling machine sed for drilling and countersinking holes in ships' ecks. The machine is mounted on a barrow, so that t is easily moved about, and there is a lever for lifting the drilling part with its electro-magnets clear of the decks ready for transport. When countersinking, such machines can be quickly moved from hole to hole; one man can readily countersink from 900 to 1,000 holes in a day.*

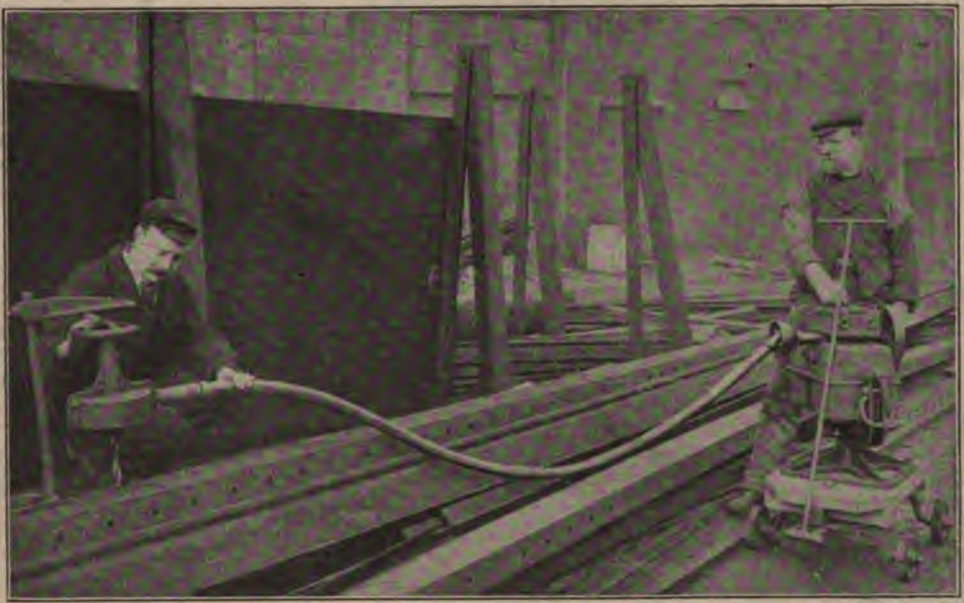
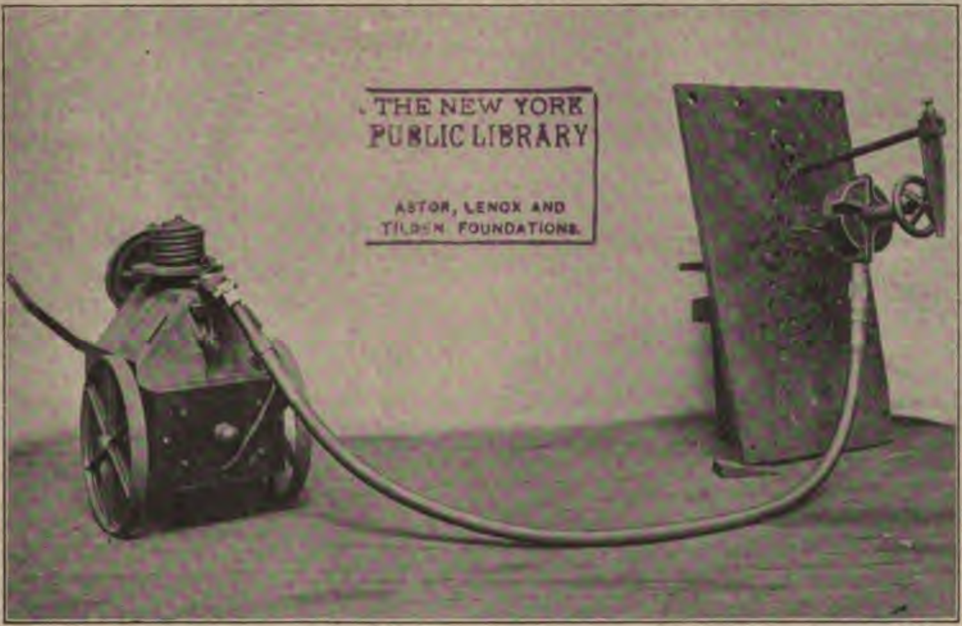


Fig. 2.



THE NEW YORK
PUBLIC LIBRARY
ASTOR, LENOX AND
TILDEN FOUNDATIONS

Fig. 3.

Electric Deck Planer.

Electric motors are also being applied to the planing of wooden decks, with considerable success. Fig. 5 illustrates Messrs. Mavor & Coulson's deck planer. A small electro-motor is mounted on a frame having revolving cutters underneath, actuated by the motor through gearing. The machine is controlled through a resistance by means of a switch on one of the handles; when in use it is pushed along the deck. The depth of the cut is regulated by rollers, upon which the machine runs, the rollers being adjusted by means of a lever. About 3 H.P. are required to drive the apparatus.

---

* The author is indebted to the Thames Iron Works and Shipbuilding o., Ltd., for the illustrations of the electric drills.

ELECTRO-MAGNETS FOR LIFTING PURPOSES.

Electro-magnets are being employed for lifting such objects as shells and pipes: the magnets are attached to the end of the lifting chain, and controlled from any convenient point. The economy effected in time and labour is found to be very considerable.

ELECTRO-MAGNETS FOR EXTRACTING IRON FILINGS.

Electro-magnets are also being used in engineering shops, with pointed poles for extracting iron filings or splinters that have got lodged in the eye of a workman. The instrument has a drawing force of about 14 lbs. The eye of the patient is held near the point until the magnetic power begins to draw upon the splinter. If not too deeply embedded, the splinter will leave the eye and become attached to the magnet. Electro-magnet machines are extensively used for separating iron borings and turnings from brass turnings.

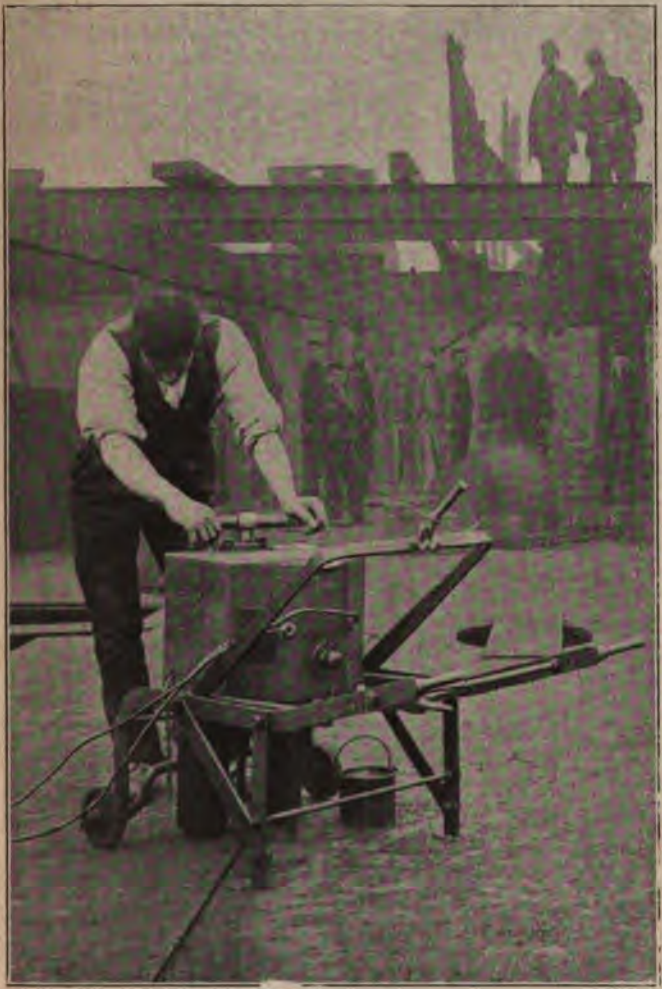


FIG. 4.

MAGNETIC LATHE CHUCKS.

Magnetic lathe chucks are now being made in America, so as to do away with bolting, strapping, or otherwise fastening down work by the usual methods. The mechanism consists of an electro-magnet made in box form completely enclosing an electric coil. A switch is provided to manipulate the current, which may be taken from the shop-lighting current. Magnetic friction clutches are also being employed now in many engineering works. Another interesting application of electro-magnets is for the removal of mill scale from pickling solutions.

THE REMOVAL OF MILL SCALE BY ELECTRICITY.

The removal of mill scale is a matter of considerable moment with many large engineering firms. The ordinary pickling process is tedious and costly, so electricity is now being used to hasten the process. The removal of scale from forgings and plates has always been a matter of difficulty, the scale in many cases being over 1-64th in. in thickness, and very adherent. The usual practice is to place the iron in a solution containing one part of hydrochloric or sulphuric acid to 10 parts of water, for a period varying from half-an-hour to 24 hours: half-an-hour for close annealed sheets, 24 hours for plates and forgings such as are employed for ship and bridge building.

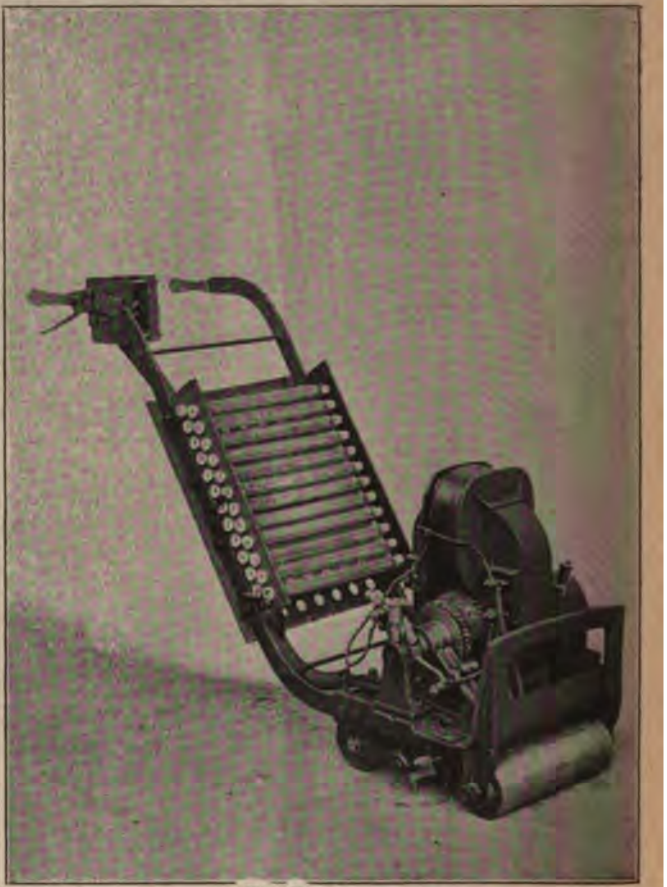


FIG 5.

One of the first experiments was to make the iron to be pickled the anode in an acid bath, but this was found to pit the plates, as the iron which was not protected by the mill scale was more readily dissolved than that covered by the magnetic oxide. To overcome this difficulty, the current was reversed every few minutes, the iron being alternately made anode and cathode. To quicken the process, and to reduce the electrical resistance of the solution, it is found advantageous to heat the pickling solution or electrolyte, which can be done by means of a lead pipe, through which live or exhaust steam passes.

A device for catching the scale soon after it is removed from the plates, so as to prevent the further unnecessary consumption of acid by dissolving the mill scale after removal, has been tried with satisfactory results. The solution is circulated by means of a small pump, through a lead-lined box or chamber, behind which are placed electro-magnets, the result being that, as the solution flows past the poles of the magnets, the magnetic iron in suspension is retained, and can be removed from time to time.

In America, an electrical pickling process has been tried, the solution used being sulphate of soda or sulphuric acid. The plates to be cleansed form the negative electrode, and an iron plate is the positive electrode. The hydrogen set free from the surface of the plate reduces the oxides on the surface and decomposes any grease that may be present. A voltaic method is stated to do the work with more certainty and with less danger to the surface of the metal in the way of pitting. The articles to be cleansed are used as the positive pole of the battery, the negative pole being either carbon or wire gauze electro-plated with silver, and covered with amorphous platinum black. The bath consists of dilute sulphuric acid, containing a depolariser, such as nitric or chromic acid. The use of the latter agent is claimed to completely prevent the evolution of offensive gases.

Attempts have been made to remove the mill scale by drawing it away from the plates with powerful electro-magnets, the scale having been previously loosened by a short immersion in an acid bath or by heating.

ELECTRIC WELDING AND BRAZING.

Electric welding, brazing, and soldering is not as extensively used as it might otherwise be, on account of the heavy royalties asked for the use of the apparatus by the owners of the various processes. One of the most striking features of the process of electric welding is the precision with which heat is localised at the spot required; there is comparatively little waste of heat in the welding process itself.

The apparatus used in the Vortex system of electric welding and brazing consists of a carbon holder and a pair of carbon electrodes. In using the apparatus, an arc is struck between the electrodes, and owing to the material of which these are made and the arrangement of the holder—the carbons making with each other an angle of about 90 degs.—a flame like that of a gas blow-pipe, but with a greater range of temperature, is projected from between the adjacent ends of the electrodes, and is directed upon the material to be heated.

The portion of the blow-pipe flame close to the carbon points is of the highest temperature obtainable by known artificial means, and the temperature gradually decreases as the distance from the electrodes increases.

When using the apparatus, a mask is used provided with eye-holes covered with dark glass to protect the eyes and the face from the intense light and heat radiated from the arc. The current usually employed for heavy work is about 150 amperes at 50 volts. The following are the comparative figures of the cost of brazing and filing up a cycle frame as given by the owners of the Vortex process.

By gas and coke process—with gas at 2s. 10d. per 1,000 cubic feet:—

	s.	d.
320 cubic feet of gas	1	1
Wages 1½ hour for brazing at 9d. per hour	1	1½
Wages 4 hours and 20 minutes filing off at 8d. per hour	2	10½
Wear and tear of files, air blast and coke	0	8
	5	9

By Vortex process:—With electricity at 3d. per Board of Trade unit:—

	s.	d.
1½ unit of electricity	0	4½
Wages 50 minutes for brazing at 9d. per hour	0	7½
Wages 1 hour for filing off at 8d. per hour	0	8
Consumption of carbon electrodes and wear and tear of files	0	2½
	1	10½

New teeth have been successfully built up on cast steel pinions and driving clutches by the Vortex process.

Zeroner's process of electric welding and soldering, is somewhat similar to the Vortex, but the flame is drawn out by means of a magnet. If the magnet lines of force of a horse-shoe magnet, and the lines of the electric arc, cross each other horizontally and rectangularly in a plane, the arc becomes vertically diverted to this plane, and resembles a blow-pipe flame. To ensure a steady flame, the carbons are of a very hard quality.

Electric welding is being used by several makers of steel barrels, the longitudinal seam being welded by the Barnados system. A bent sheet is clamped with its two opposing edges some ¼ in to 3-8ths in. apart. Small fragments of steel are placed over the opening, and melted by means of the arc, whilst an attendant hammers it as soon as ready. By welding on successive fragments in the manner named, the whole joint is finally completed, and the cask is finished by adding its heads and bung-bosses, which are also welded on in a similar manner.

In the Barnados system, the article to be operated upon constitutes one pole, and a carbon pencil attached to a portable insulated holder constitutes the other pole, an electric arc being struck between the two poles.

When steel and iron are being welded, it is usual to make the carbon the negative pole, but for other metals the poles are sometimes reversed. This process is being used by Messrs. Lloyd & Lloyd, of Birmingham, in connection with their tube business.

Steel pipes have been successfully welded [illegible] process for a length of about 10 ft., [illegible] the tube being 13 in., and the thick [illegible]

¼ in. The rate of working is about one foot in seven minutes. The dynamo used for this class of work is usually of the compound-wound type, having a capacity of 250 to 300 amperes at a pressure of about 85 volts.

An electric welding chain apparatus, designed by Mr. Taylor, who is working under licence from the Thompson-Houston Co., is said to produce chains at a cheaper rate, and the breaking strain is found to be considerably higher than hand-made chains. The Thompson-Houston process is one of the best known. No arc is used in this process, the metal being heated by passing a heavy current through the portion it is desired to weld or forge. The apparatus employed consists of :—

1. An electric generator for producing a low pressure alternating current.

2. A reactive coil or rheostat or both, for compounding and regulating the exciter, dynamo, and generator.

3. Fuse-blocks or cut-outs to prevent damage, to the generator and welder.

4. A transformer provided with suitable clamps to tightly grip and hold in place the pieces to be welded—the mechanical, hydraulic, or other device by which the abutting ends or surfaces of these pieces are forced together.

In the larger types of machines provision is made to maintain a circulation of water in the copper contacts. Amongst other applications of the Thompson-Houston resistance-heating system of welding is the welding of bicycle pedals, printers' chases, carriage fittings, and hub bands.

This system has also been used for the heating of pipes for bending and locally softening the hardened surfaces of steel plates, to allow of their being drilled. Special welding machines have been constructed for welding hubs and spokes for agricultural wheels.

ELECTRICAL FORGE.

An electrical forge, which has been put into practical use, consists essentially of a tank containing an aqueous solution of some salt, preferably sodium carbonate and borax, which is used as one electrode, and an insulated metallic bar for the other electrode. The work to be heated is placed upon a rest, and the other ends brought into contact with the surface of the liquid.

An arc is produced at the point of contact with the solution accompanied by great heat, the piece to be worked becoming white hot in a very few seconds. The heating effect can be confined to the end of the rod or piece to be worked, or extended over a length of several inches.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

In War. In Peace.

FROM Messrs. Richardson, Spence & Company I have received, under the above title, a little volume whose perusal will repay all those who are interested in the fleets of the mail lines. It will also be most instructive and convincing to any of those who, whilst asserting that the reliance of the British Admiralty on the auxiliary armed cruiser system is a mistake, still keep an open mind. The book in question is profusely illustrated with the finest specimens of American magazine art. There are illustrations of the four vessels of the American Line which took part in the American-Spanish war, both as they appear when pursuing their peaceful vocations as mail and passenger steamers, and as they were when they were doing such good service to assert their country's will, and to extend the freedom of the Anglo-Saxon race to the fairest of the West India Islands. But one faint criticism can be made against the methods of the artists who are responsible for the adornment of the volume in question. It is this: Each chapter of the book has very artistic head and tail pieces, as indeed have most such volumes *de luxe* produced on the other side. American artists are wont, it would appear, to work these designs over the letterpress at the head of the chapter. The effect of the designs is greatly enhanced, no doubt. But I venture to think that facility in reading the matter of the book is thereby sacrificed, and no beauty of design will excuse that. The artist's work should ever be explanatory of and subsidiary to the work of the author. The description of the two pairs of sisters, the Clyde-built *Paris* and *New York*, and the Philadelphia-built *St. Louis* and *St. Paul*, are already well-known to the readers of the MARINE ENGINEER; but the interest in their war experience is enhanced to those who best know them as merchant vessels, and the book would have been decidedly wanting in balance had it not dealt with them in both aspects. The work they did, when so quickly recalled and mobilised for war, seems to be of a character which no other vessels, save mail steamers, could have undertaken. Their power to maintain full speed for long periods of time, and to carry enormous quantities of fuel, so that they could hold the sea for weeks, are not within the usual range of design of warships, and these points stood them in good stead indeed. They managed, too, to show themselves good fighting ships against vessels which might well have been considered too dangerous for them to stand up to. This fact, however, seems to speak more for the men who handled than for their construction. The book as a whole is a record of what private enterprise and members of the merchant marine can do for their country in times of national emergency; and not the least pleasant part of the book is the appendix which gives the name of every man, however humble his position, who remained in his ship and saw active service when the vessels were taken up by the Navy Department. To the engineers' department, who kept their machinery in high condition under such circumstances as fell to their lot, especial praise must be given by all those who are able to appreciate the actualities of their service. The book is a record of episodes of which all English-speaking people—especially those connected with the sea—may well be proud.

An Amusing Rumour

has been circulated in regard to the new White Star service to Australia. It is said that the P. & O. directorate is so annoyed at the entry of the White Star Line into a trade which they look upon as a preserve of their own that they contemplate retaliating by starting opposition to Messrs. Ismay Imrie & Company's New York service! It would be curious to know how they would go about this. Will they put the *Shannon*, now good enough to carry the Indian mails, on in competition with the *Oceanic*; or will their crackest boats, the *Arabia* and the *India* be withdrawn from the Australian service for the New York trade? Fifteen knots is the sea-speed even of these modern ships, and in Atlantic weather the *Cymric*, the White Star passenger and cargo boat, would give a very good account of any of them. I do not think carrying war into the enemy's country is quite the policy of Leadenhall Street. It is but the other day that the directors of P. & O. purchased the three Hall Line boats with the stipulation—as reported—that their late owners should retire from competition in the passenger trade. The stifling of opposition in this way is much more consonant with P. & O. traditions than the cutting into established and powerful trades.

The "Gaspesia."

The great venture which was to render antiquated the route to New York and teach the crack Cunarders and the new *Oceanic* that their paces were shown all in vain will, it would appear, never carry out its programme. The Canadian Steamship Company, Limited, was unable, as we have already seen, to obtain the accession of strength which it contemplated by the purchase of the old Norddeutscher Lloyd express boats *Werra* and *Fulda*. Its sole acquisition, the *Gaspesia*, is now again announced for sale. After her long continued adventures in the ice—outside the port which it was boasted was always accessible throughout the year—she went to St. John's, Newfoundland, where she was the subject of a salvage action and of a sale. Thence she proceeded to Bathurst, where she shipped a cargo of deals and these she is now discharging in Glasgow. She is an iron screw steamer of 26 years of age, built on the Clyde by Messrs. Robert Napier & Sons. She was then called the *Galicia*, and her owners till a couple of years ago were the Pacific Steam Navigation Company, of Liverpool. The names of her builders and original owners are a sufficient guarantee of what she once was. But Paspebiac now awaits further exploitation.

The Transport Service.

The newspapers and men's thoughts are now fully occupied with the Boer war. With this the fleets of the mail lines are fully concerned, and, indeed, the part which they are taking in the matter is one which has never been played before either by them or any other marine in any time or country. The task which they have willingly taken upon themselves to perform could only be taken up by the British Mercantile Marine, and that only at the close of the present century. An army corps comprising some 50,000 men has to be transported 6,000 or 7,000 miles, and the task is being commenced with few and inconsiderable hitches and without any disorganisation of the ordinary trade of the country.

The Union Company and the Castle Line to the Cape are naturally playing a very important part in the work. Not a steamer leaves Southampton of either of the two lines but she is very fully occupied with troops and equipments. Before the declaration of war, for example, the former company's steamship *Gaul* took out the Northumberland Regiment on the 16th September, and the mail steamship *Tantallon Castle*, sailing the same day, had on board Sir George White and his staff. The *Norman*, following a week later, had a number of officers, whilst the *Kinfauns Castle*, on her maiden trip from Southampton, on the 30th September, took out 300 men, and made a very rapid passage with them. That day, too, the Union intermediate boat *Gaika* sailed with a heavy complement of military. Perhaps it is unnecessary, with regard to their Saturday's work, to do more here than to remark that each Saturday the mail boats and the intermediate steamers of the respective lines find themselves busy indeed in consequence of the war. Beyond all this the two companies have chartered all the tonnage they can spare from the weekly service for the work of the nation. Seven Union ships are officially returned as being employed. Of these the *Spartan* and *Trojan* have been fitted up as the two most complete hospital ships ever sent to sea. They have been despatched, and their work will be to carry wounded from Natal to Capetown. The others in this line taken are the mail steamer *Mexican* and the four "G's", *German*, *Gaika*, *Goorka*, and *Gascon*, the two last-named sailing on the 21st October. Of the Castle Line six steamers are taken, including the new twin-screw mail steamer *Kildonan Castle*, on which the Fairfield Company is at work night and day to complete her fittings for a troopship. On the 20th October the *Lismore Castle*, *Roslin Castle*, and *Harlech Castle* all left Southampton with large drafts of the Army Corps, the *Braemar Castle* having preceded them by a week, and the *Hawarden Castle* following them at a three days' interval. Of the Atlantic companies, Cunard's responded to the country's invitation by giving up six vessels. The first of these was the *Carinthia*, then at Boston, which proceeded early in October to New Orleans to load mules for South Africa. Then followed the *Servia* and the *Catalonia*, the *Cephalonia*, the *Pavonia*, and the *Aurania*. Of these the two last departed with the first contingent of the Army Corps from England. The White Star Line afforded three ships. One was the new steamer *Medic*, then opportunely at Sydney. She was taken to bring over the New South Wales troops; the *Nomadic* went from the Thames with a large number of horses, for whose carriage she was peculiarly adapted, with the first contingent. The third is the reserve mail steamer *Britannic*, which left Liverpool on the 24th October, calling at Queenstown. The West India and Pacific Company supplied the *Columbian*, *Antillean*, and *Jamaican*. The Harrison Line provided their *Dictator*; the Leyland Line, the *Armenian*; the Johnson Line, the *Templemore*, and the *Ismore*: the Wilson Line, the *Chicago* and *Idaho*. Messrs. Harland & Wolff sent the *Englishman*, which has been running the Dominion Line; Messrs. Houlder Brothers the *Florence*, *Southern Cross*, *Langton Grange*, and *Urmston Grange*. Messrs. Houston's was a large contingent, and the enterprising owner, of these ships saved much time in the work of preparing them for duty by the introduction—as is believed for the first time on record—of the telephone from the Central Liverpool Exchange to the ships in dock. From his fleet there were sent the *Hyades*, the *Hellopes*, and the *Herminius*, with the new steamer *Kelvingrove*, which he had just chartered. Mr. A. L. Jones provided the *Arawa*, just engaged for his Bristol mail service, the *Mount Royal*, the *Montezuma*, the *Montfort*, the *Monarch*, and the *Prah*. Of the Allan Line, there is engaged the new *Bavarian*; one of the largest ships to be employed, and also the *Mongolian* and the *Siberian*. Of Messrs. Houston's, Jones's, and Houlder's vessels, several will be employed in the carriage of mules from the States, Italy, and South America; of the Anchor Line, the *Persia* and the *Algeria*; of Messrs. George Smith & Co.'s fleet, the *City of Cambridge*, the *City of Vienna*, the *City of Venice*, and the *City of London*; of Messrs. Bibby's Line, the *Yorkshire* and *Cheshire*; of Messrs. Brocklebank's, the *Pindari*; of the Pacific Steam Navigation Company, the *Orcana*; of the National Line, the *America*; of the Orient Line, the refitted *Orient*; of the Thomson (of Dundee) Line, the *Hurona* and the *Devona* of the Asiatic Steam Navigation Company's, the *Ranee*, *Nairung*, and *Nurani*; of the P. & O. Company's there are eight ships, the *Oriental*, *Malta*, *Nubia*, *Manila*, *Formosa*, *Simla*, *Sutlej*, and *Sumatra*. But the British India Steam Navigation Company supplies the largest number of bottoms, the total is twenty-two vessels. Of these, the principal are the *Avoca*, *Linoula*, *India*, *Dunera*, *Dilwara*, and *Jelunga*. But there are also included in the list the *Zayathla* and the *Zibenghla*—these were formerly, under other names, of the New Zealand Shipping Company. The change of ownership was chronicled in these notes but a short time ago. The two ships in question have caused some comment in the press in that they are the only vessels which have so far been reported as being delayed by the necessity of repairs. It would seem at least a curious coincidence that two ships whose history, both ancient and modern, is very similar, should be the two by the failure of which the transmission of men and material whose presence in Natal is urgently needed for Imperial purposes should have been delayed. The list I have given, though very lengthy, is by no means exhaustive, but it may be of use to our readers. Perhaps the best idea of what is being accomplished as a whole by the Government and the shipowners may be gathered from the statement that between the 30th September and the 24th October no less than 16 big transports were, according to programme, got away from the two ports of London and Southampton. The shipowners, if they are getting good employment through the war, are not slow to show that they are willing to share their good fortune with those who are ruined by the state of affairs in the Transvaal. For the Refugees Fund the Union and Castle Lines have each contributed the sum of one thousand pounds. Other shipowners, too, have put their names down for very handsome sums. Besides giving money, however, there are offers which will be valuable indeed to the poor people who are suffering from the tyranny of the Transvaal Republic. Messrs. Lamport & Holt, who have but one steamer chartered, and Messrs. Ismay, Imrie & Company, who have several, have each instructed their Capetown agents to afford free passages to England in their returning transports to deserving cases. Again, the Atlantic Transport Company, which has but one vessel (the *Mohawk*) chartered, has made a noble offer of their steamship *Maine*, with her officers, to the Government for use as a hospital ship.

The Condition of the River Thames

is becoming scandalous. Attention has been frequently drawn of late to the fact that, though the size of steamships is constantly and quickly increasing—that though New York talks of making a channel to its port with a minimum depth of 40 ft.—nothing is being done in the Thames. This neglect has been carried too far. The Atlantic Transport Company's experience with their steamship *Marquette* is a very fair example. The steamer named, though a fine modern vessel, is by no means as large as some that cross the Atlantic, and when she reaches the Thames she is obviously drawing considerably less water than when she crossed New York bar on sailing. The *Marquette*, however, drawing 27 ft. 6 in., on a recent trip was kept nine hours waiting for water at the Nore, and after that had to wait another three at Gravesend for the same cause. Thus half-a-day was lost to her owners and their customers. With the engagements which vessels plying in our big lines now have for forward shipments (especially with regard to cattle and dead meat) such delay is most costly, since it may happen, if unduly prolonged, to upset the whole organisation of the line. The sooner the Thames Conservancy awakes to its responsibilities, and turns its attention to matters of this urgent kind, the better for itself and for the port of London. No doubt it prefers making itself objectionable on the Upper Thames to buckling to serious work below London Bridge. But, if it fails to do its duty, it will very soon find its authority transferred elsewhere.

Le Repertoire Generale de la Marine Marchande,

in its thirtieth edition, just now being published, gives an interesting *resume* of the state of the world's shipping in respect of numbers of bottoms and tonnage. Having regard to sailing-ship tonnage, in vessels of 50 tons and upwards, the present return shows a decrease of 1,018 vessels and 346,143 tons on the figures which were presented a year ago. Of the sailing vessels which "Le Répertoire" regards, there are now but 27,867, with a measurement of 8,347,626 tons. The British decrease is, of course, the largest, our marine being so much the greatest. The shrinkage is very little under a quarter of a million of tons. Norway has shrunk 187,000 tons, Greece has lost 40,000 tons, and Spain 11,000; whilst Germany has gained 92,000 tons, France 30,000 tons, Italy 29,000 tons, and Turkey 9,000 tons. In steam tonnage the process is very different. The world's total here is 11,456 vessels, with a gross tonnage of no less than 19,711,382 tons, reckoning only vessels of 100 tons gross and upwards. A year ago the tonnage was 824,250 tons less; but it was contained in 120 more bottoms, so that there is a distinct, if not very great, increase in average size marked. Great Britain has 5,453 steamships, against 900 in the case of Germany, the next in the list. Norway is third in point of numbers with 657, the United States fourth with 551, and France fifth with 526. Sweden has 497, Russia 435, Spain 377, and Japan 332. Regarding tonnage instead of mere numbers, the order is somewhat different, Great Britain still heads the list with over eleven millions of tons, her figure of the previous year being increased by about 95,000 tons. Germany again comes second with 1,873,000 tons. She has increased her total by 248,000 tons. France, though she has fewer steamers than the States, has a better average in size. She comes third in steam tonnage with 986,000 tons—an increase of 33,000 tons. The States have 971,000 tons, against 810,000 tons the previous year. The decrease here is probably owing to the fact that the present figures show against those of a year exceptionally swollen by the exigences of a naval war. Norway is fourth with 672,000 tons, against 628,000 tons a year before. Spain has increased her figure by 31,000 tons to 552,000 tons. Japan, with an increase of no less than 114,000 tons, shows a very big jump. Italy is up 23,000 tons, and Russia 49,000 tons. The figures would be interesting in any event; but in connection with the work which we see the British Mercantile Marine fulfilling in the transportation of the Army Corps, the figures seem peculiarly suggestive.

Bristol and its Docks.

One does not know whether it is worth while to spend more ink on the discussion of the plans of the Bristolians in regard to dock extension. So much discussion has gone on in the City Council, so much writing has been made in the press as to the three rival schemes of (1) dockisation of the Avon, (2) improvements at Portishead, or (3) extensions at Avonmouth, only to see everything dropped, that little attention should be given to what is said, and a pause should be made by outsiders till something is done. But it may be well, for the sake of completeness, to mention that Alderman Baker, the chairman of the Docks Committee, has informed the Town Council that, if they will set their hands to something which will afford promise of better accommodation for the larger class of mail steamships characteristic of the day, the name of Bristol will be inserted, as an alternative port, in certain proposals which he is about to submit to Government. The anonymous gentleman would wish to be enabled to state on authority that, within two years, the required better accommodation should be available. And in consequence of the shortness of time all that could be offered him was an improved Portishead. That he is said to be prepared to accept, and so Alderman Baker becomes an adherent of the Portishead scheme. The lock is to be lengthened so as to admit big vessels, and an additional £25,000 is to be spent on giving long ships room to turn within the dock itself. Altogether the cost involved would be something about £375,000. The City Council adopted the recommendations by a majority of 13 votes. It was stated that the income to be derived from the visit in each week of one such liner as was contemplated would give revenue sufficient to make the investment directly remunerative. The only observation to be made in the matter is, Where will the city be if the other alternative port to Bristol be selected by the Government? Possibly the answer to this is that the provision of larger and better docks is absolutely necessary if Bristol is to keep the trade she has; and that, if she once has advantages for dealing with big ships—having the trade she has—she may confidently look for expansion to recoup her for her outlay.

The Dangers of the Canadian Coast.

In connection with the recent losses of big liners, such as the *Scotsman*, the *Bay State*, and the *Prodano*, on the coasts of Canada, and the determination of the owners of the first-named ship never to allow their vessels again to pass through the Straits of Belle Isle, a very interesting table has been prepared by the energetic secretary of the Liverpool Underwriters' Association. It regards all the important casualties to steamships which have occurred on these coasts or in the River St. Lawrence. From it we see that Belle Isle is a dangerous place enough; but it is hardly responsible for more disasters than the neighbourhood of Cape Race, which is a danger to those vessels which ply to northern United States Atlantic ports, as well as to such ports as St. John, New Brunswick. There are not enough statistics available to show what may be the risks of the passage of the Cabot Strait, which is the entrance to the St. Lawrence alternative to the Straits of Belle Isle. But one thing is abundantly clear. If the St. Lawrence itself has a good many accidents to vessels navigating its course, it also has a practical monopoly of the partial losses in the cases under notice. What Cape Race and Belle Isle get they usually keep. The bad weather and the currents which prevail in these vicinities give little opportunity for salvage. Stranded vessels soon go to pieces or slide off the rocks into deep water. But in the St. Lawrence itself conditions are naturally far otherwise. At the same time, as Sir Louis Davies, the Canadian Minister of Marine and Fisheries, recently pointed out, the Canadian Government is well alive to its responsibilities in regard to the navigation of its great river. It has taken the management of the affairs connected with its safety into its own hands. It has recently built a new lighthouse at Belle Isle. It is building another in a dangerous part of the St. Lawrence, and the whole question of lighting and buoyage is being attended to.

The Mersey Docks and Harbour Board

is taking every opportunity of doing all it can to bring its graving dock accommodation up to date. Having recently completed the biggest dry dock in the world, adjoining the Canada Dock, it is now about to spend just over £200,000 in the construction of one which will only be inferior in size to this one of their own. The new structure is to be named the New Sandon Graving Dock. It will lie immediately to the south of the branch No. 1 of the Huskisson Dock. The sill is to be 18 ft. below the level of the old dock sill; the length will be 1,000 ft. and the width at entrance 95 ft.

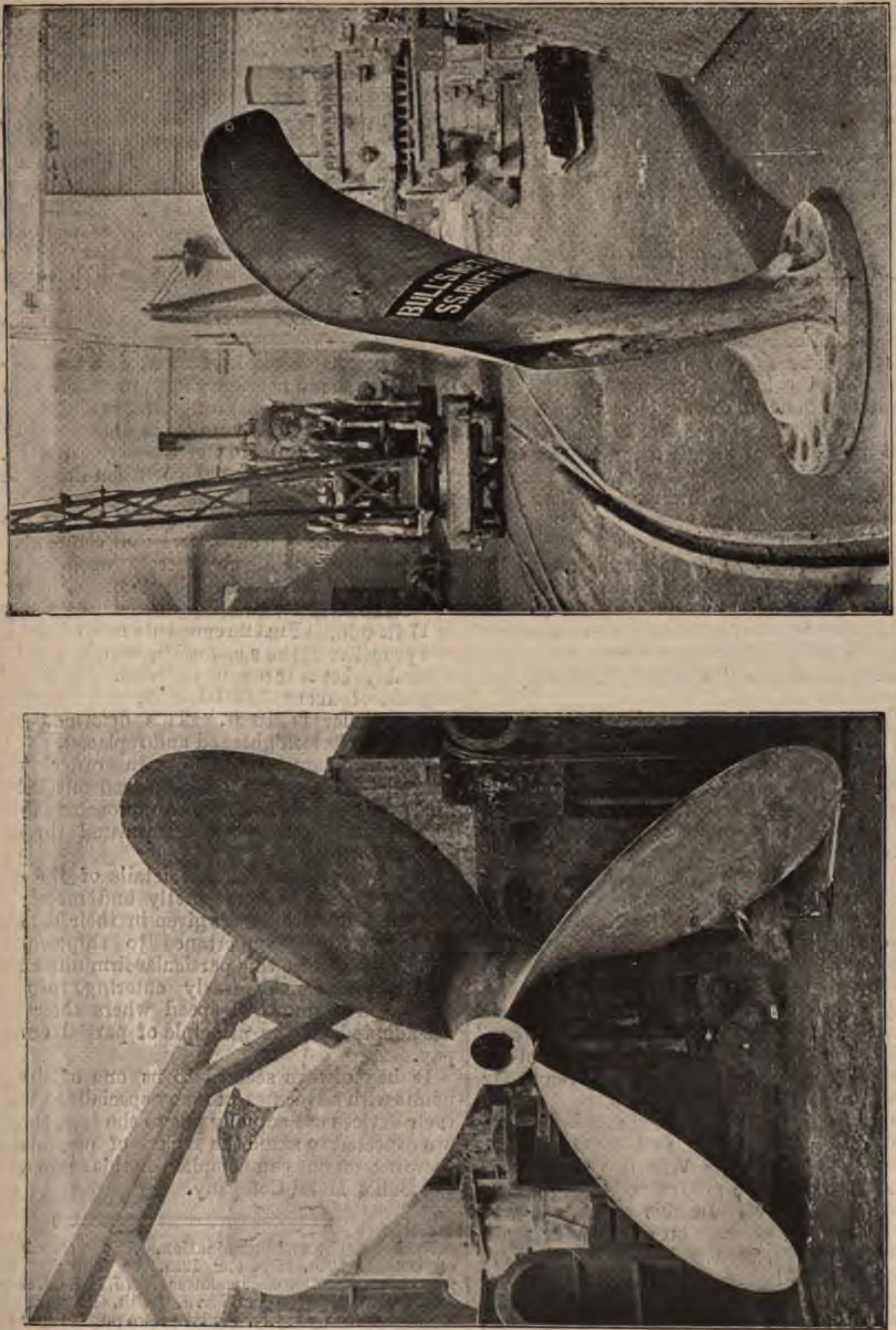
On the Continent

Bremerhaven

has the distinction of having, in the new Kaiser Dry Dock, opened in September, the biggest graving dock yet constructed outside of this country. It is also the only stone dock of the kind in Germany. It is chiefly designed for the accommodation of the vessels of the Norddeutscher Lloyd fleet. Its length is 721 ft. 9½ in., its breadth is 90 ft. 6½ in., and the sill is 34 ft. 8 in. below the highwater mark of the River Weser at ordinary tides. Four cranes, all worked by electricity, are provided. The largest of these is equal to a duty of 120 tons. The whole cost amounts to about £295,000, of which £120,000 is paid by the Imperial Exchequer. A lease of the dry dock has been taken for 25 years by the Norddeutscher Lloyd Company at an annual rent of something under £6,000, but the dock will be available on payment to vessels outside its fleet, and of course to German men-of-war. A repairing basin and other dry docks are also comprehended in the scheme, of which the present is merely an instalment.

Mr. Ismay,

who was not well enough to be present at the view of the new steamship *Oceanic*, or to fulfil his desire to cross with her on her maiden trip, still remains in a very serious state. His strength does not seem to come back to him in the way in which those who know the vigour of his constitution, and who are anxious to see his complete restoration to health, would desire. I had left all notice of his illness to the end of these notes in the hope



BULL'S METAL
SS. BUFF

Fig. 1.

Fig. 2.

Bull's Metal Propellers.

that some better news might have been given, but I fear as yet there is none. The feeling in Liverpool, and indeed on both sides of the Atlantic, towards him, especially at this time, is very warm and anxious. The German Emperor, who is perhaps famous for telegrams, sent a very gracious message to the devoted wife, who is nursing the invalid with such tender solicitude at Dawpool, and he expressed in a very happy way the anxiety with which those who know Mr. Ismay regard his illness, and the high appreciation with which every one who has met him—be they high or humble in rank—esteem his force of character.

BULL'S METAL PROPELLERS.

SOME time since we drew attention to the results obtained from propellers manufactured by Bull's Metal and Melloid Co., Limited, of 6, Jeffrey's Square, St. Mary Axe, London, E.C., and we have now before us a new edition of the company's catalogue just recently published, which contains a considerable amount of most interesting information relative to propellers, and shows by the copies of testimonials set forth that excellent work has been done by the company during its short independent existence; and, further, that the claims originally made by the company in their first catalogue as regard the improvement in speed or economy with their propellers have been fully substantiated.

Although the company do not pose as specialists in the design of propellers, and are not bound to any particular type or class of design, yet it is obvious from the argument and suggestions presented in their catalogue that they think considerable advantage is to be gained by the solid propellers, which is, no doubt, founded on experience gained with propellers supplied by them.

It is stated by the company that the loss in speed entailed by the use of a loose-bladed propeller, as compared with a solid one, is fully quarter of a knot on an average boat, besides the disadvantage that the extra strain on the shafting with the loose blades must be fully 25 per cent. higher. Of course it is the individual shipowner who is the best judge as to whether, in his particular trade, such a loss of speed or avoidable increase of risk to his shaft, and the matter of prime cost, are balanced by the undeniable advantages of the loose blades in case of breakages.

In the testimonials, a number of interesting facts in respect of actual speed improvement are given, and the company are so confident as to the merits of their goods that an absolute guarantee of speed improvement is frequently given to their customers, and we are informed that satisfaction has been given so far in every case with a single exception.

We think the case of the propeller supplied to s.s. *Eldorado*, of 1,515 tons gross and 2,000 I.H.P., belonging to Messrs. Thomas Wilson, Sons & Co., is the most interesting; the guaranteed improvement in speed was half a knot. In this steamer it was found that the record passage on a particular route during several seasons, with a cast-iron propeller, was 369 knots in 26·47 hours, giving an average speed of 13·77 knots per hour; whilst, with the new Bull's metal propeller, between the same points, the same distance was covered on the first voyage in 25·11 hours, which gives an average speed of 14·652 knots per hour, showing an improvement in speed over the cast-iron propeller of ·88 knots per hour. The improvement obtained was fully one knot when comparing an average of a number of sea passages.

Those interested in cargo steamers will, however, be more interested in the reports in respect of the vessels s.s. *Planet Mercury* and the s.s. *Blanefield*.

In the case of the former, a speed improvement of fully two-thirds of a knot per hour, on the same coal consumption as with her cast-iron propeller, is proved by the superintendent engineer's report, and it may be added that after five years' work this propeller continues to do equally good, or rather better, service. This result tends to prove that the pitting and corroding of cast-iron or steel propellers is one of the most potent factors in the falling off in the speed of new or newly-repaired vessels which so frequently forms a complaint amongst shipowners.

It may further be remarked that the s.s. *Planet Mercury*, like various other vessels using Bull's metal propellers, has never been fitted with the zinc plates, which are found necessary for protection against galvanic action with most other bronze alloys.

Careful painting when docking has proved sufficient to protect the hulls, in the cases referred to, against any prejudicial amount of corrosion due to the Bull's metal.

We illustrate in the adjoining diagrams two specimens of work executed by the company. Fig. 1 represents the solid Bull's metal propeller, supplied to a vessel of 6,000 deadweight tonnage. Her engines are 2,100 I.H.P., and the diameter of the propeller is 17 ft. 3 in. Fig. 2 represents one of the blades of the propeller of the s.s. *Buffalo*, which has been considerably bent through collision. This vessel has engines of about 3,000 I.H.P., and the diameter of the propeller is 19 ft. This deformed blade was subsequently straightened and replaced.

The company have now in order two solid propellers, each of which is to transmit 9,500 H.P., and, as far as we know, powers approaching this amount has never before been transmitted through solid bronze propellers.

We have given such full details of the company's labours for two reasons: firstly and mainly, because we think the actual facts given in their catalogue are of interest and importance to shipowners; and, secondly, because this particular firm differ from most of their rivals by freely entering into absolute guarantee of improved speed where their propellers are adopted, on the principle of partial cure, partial pay.

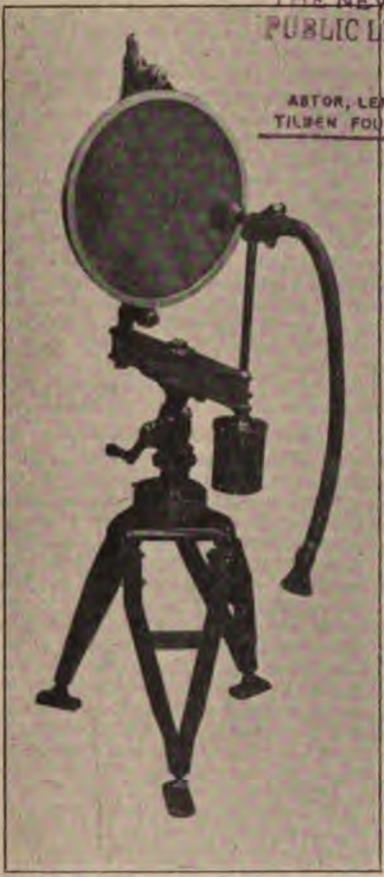
It has always seemed to us one of the weakest points with advocates of many specialities that, when their devices are actually put to the test, their clients are expected to stand the racket of possible failure; however, no one can complain on this score as regards the Bull's Metal Company.

Marine Engineers' Examination.—At the examination held on October 10th, 11th, and 12th, the following candidates passed for extra first-class engineer: Mr. J. R. Reid, Sunderland; Mr. L. Parker, Leeds; and Mr. J. Smith, Glasgow. All passed the first time of going up, the latter two pupils being instructed entirely by correspondence. They were prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields. Sixty-three pupils have passed in the above grade from this establishment, a record unattained by any other existing school.

COWPER-COLES SOUND LOCATOR AND PROJECTOR.

THIS instrument is for the purpose of readily locating the direction of a sound, and for projecting sound long distances. The instrument consists of a reflector, which is made entirely by electro-deposition, mounted on an arm which can be readily turned on its centre, and depressed or elevated by the operator. When it is desired to ascertain the exact direction from which a sound emanates, the apparatus is turned on its axis; and, as soon as the reflector is opposite the source of sound, it is heard much intensified in the receiver.

THE NEW YORK
PUBLIC LIBRARY
ASTOR, LENOX AND
TILDEN FOUNDATIONS.



When it is desired to carry on a conversation between two distant ships or points, two instruments are used, so that the beam of sound is thrown from one reflector to the other and focussed in the receiver of one instrument: one operator speaks into the flexible tube, whilst the operator working the other instrument places the tube attached to the receiver to his ear. Conversation can thus be carried on at long distances without unduly raising the voice.

Some experiments have recently been made at St. Margaret's Bay, near Dover, with this instrument. The ticking of a watch when placed in the focus could be distinctly heard by observers about 20 ft. away, even with a strong breeze blowing across the line of direction of sound.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

Missing Signal Books.

MANY theories have been put forward to account for the loss of two signal books from the *Duke of Wellington*, but up to the present no clue has been found as to who took the books or where they have gone to. The volumes were Nos. 1 and 2 of the Fleet Signals, and were heavy, bulky books, so that considerable care must have been taken in their removal to prevent detection. One theory put forward is that they were stolen for the purpose of disposal to a foreign Power, but it is questionable whether any foreign Power is in ignorance of the contents of these books. In time of war an entirely different code would be used to that set forth in the missing volumes. Of course, many useful "wrinkles" could be learned from them by other Powers. The second theory put forward is that they were extracted and destroyed in order to gratify malice cherished against the officer responsible for their safe custody; and the third theory advanced is that a signalman, wishing to improve his chances at the next examination, took them home for private study, but, finding that their absence had been discovered, destroyed them. Time will perhaps show whether any of these guesses are correct. This is not the first time that signal books have been missed, and it is hoped that it will be the last, and that in future a stricter watch will be kept on these volumes. It is regrettable that suspicion should be cast upon the Signal Corps, for these men are on the whole honest and hard-working. It is worthy of mention here that a signal book belonging to one of the officers of a destroyer was dropped overboard in Falmouth Harbour early last month, and, although divers were sent down to find it, they were unsuccessful in their quest.

A Lower-Deck Grievance.

It is almost a tradition in the navy amongst the younger seamen, stokers, and marines afloat that their canteens are mismanaged. The majority of these men entertain a belief that there are very few who gain any benefit from such an institution, and that the greater part of the profits is spent in paint and gold-leaf for the decoration of the ship. The regulations lay down that the establishment of dry canteens shall rest with the captains, who shall cause proper rules to be framed for their administration, and submit these rules to the Commander-in-Chief for his approval. The rules also say that the affairs of the canteen shall be administered by a representative committee, but subsequently state that the first lieutenant shall be *ex-officio* president; whilst, at least, one other executive officer shall have a hand in the management of the canteen. The question is whether the commissioned officers know sufficient about the buying and selling of such things as groceries and other goods as to conscientiously carry out the duty imposed upon them. It would be ridiculous to credit the imputations made of officers accepting bribes from tradesmen, but that some of those who come into direct contact with the vendors of the goods sold to the canteens have countenanced a little "jobbery" is certain. A well-managed canteen should never have to record the loss of nearly £200 in a single quarter; but this is so in the case of that of the *Warspite*, and, therefore, there is plainly something wrong in the management which calls for redress. The president of the committee appears to have on one occasion used his position to make a cook buy the flour from the canteen which could have been purchased much cheaper from local tradesmen. This was certainly to prevent any greater loss, but such a state of things should not have come to pass. Canteen goods ought to be as cheap, or cheaper, than those that the men can purchase off the ship. The remedy seems to be to give the lower deck a freer hand, and not to allow the senior non-commissioned officers of the ship so much liberty as they at present have when connected with the canteen committee. If the various tradesmen dealt with submitted samples and prices which the whole of the lower-deck hands could see, the latter could easily judge by the price and quality of the goods retailed to them from the canteen whether the committee understood its work, and could act accordingly when the committeemen were elected.

Portsmouth Dockyard.

The most interesting part of the inspection by the Lords of the Admiralty last month at this yard was the review of the combined divisions of marines on Southsea Common. As the

3,000 men marched past they looked as fine a body of military men as could be found anywhere in England, or for the matter of that, in the world. The First Lord's private secretary, Captain W. H. Fawkes,has stayed on in order to superintend the completion of the new battleship *Canopus*, in which, on December 15th, he is to hoist his pennant. Although she is being pushed on as rapidly as possible, it does not look at present as though she would be ready for sea by that time. Three of the ships commissioned at this yard for the Naval Manœuvres were to be taken in hand in order to have repairs done to them. In the *Europa* and *Gladiator* some alterations were to be made in the bunker doors, as they do not work satisfactorily, but whether this work will be done yet awhile is doubtful, as most of the ships are being prepared for sea in case of emergency. It is at present uncertain whether the ships will be sent to the Cape or not. In connection with the trouble in South Africa, it may be mentioned here that the Government has decided to keep open the places vacated by dockyard labourers who have been called up as reservists, thus setting an excellent example to private firms. The periodical trials which are carried out with the ships in the Fleet Reserve have shown that several of them have not improved by keeping. The *Isis*, for instance, was half-a-knot short in speed, and the *Glatton* also failed to reach her nominal sea speed. She reported a mean speed of 9·7 knots, but the coal consumption was not reported. The best speed of the older ships was that attained by the *Sultan*, which reported a mean speed of 13½ knots. Considering the amount of money spent upon her, she certainly ought to do better than the *Iron Duke*,

A Naval Brigade for the Cape.

The announcement has been made that Sir Robert Harris is making preparations for the landing of a naval brigade at Simon's Town. Sir Robert has a total force of 14 ships under his command, the majority of which, however, are small craft, and altogether about 3,500 men. The strength of the brigade has not been mentioned, but it will probably consist of about 1,500 seamen, with a number of field pieces. Amongst the force there will probably be some of the best gunners in the Navy, for the admiral on the Cape Station is an enthusiast on the subject of efficiency in naval gunnery, and may be relied upon to send against the Boers men who can shoot as straight as any artillerist in the world. Of course all the ships are not at Simon's Town, the headquarters of the station, there being at the latter place only the *Doris* (flagship), third-class battleship *Monarch* (guardship), the cruisers *Forte*, *Magicienne*, and *Barrosa*, with the gunboats *Widgeon* and *Thrush*. The *Philomel* is at Delagoa Bay, and the *Tartar* at Durban, the first watching the Portuguese coast. It is well known ihat Sir Robert Harris intends keeping a strict watch on all vessels bound for South African ports, in order to prevent any munitions of war being landed for the Boers, and it was the knowledge of this that probably caused the captain of the German ship *Kaiser* to land her cargo at Port Said, he not caring to risk the chance of capture at Lorenzo Marques. However, large profits are to be made from the sale to the Transvaal Government of guns and ammunition, and, therefore, other owners may decide to take the risks. In connection with the despatch of the transports, several cruisers of the Channel Squadron will leave England; but not, as has been stated, to convoy the troopers. They will go to the coaling stations on the route for the purpose of guarding against any delay in the expediting of the troopships.

Skilled Mechanics for the Navy.

A difficulty is still being experienced by the Admiralty in obtaining a sufficient supply of skilled mechanics, and in this connection it has been stated that the Amalgamated Society of Engineers has decided to hamper the recruiting of mechanics as much as it possibly can. This action has been taken on account of the refusal of the Admiralty to grant the concessions asked for by the engine-room artificers, such as improved mess places, washing accommodation, &c. Considering that at present every available inch of space on a modern warship is occupied, it is not likely that the Admiralty will consent to disarrange the accommodation in warships for the engine-room artificers. The engine-room artificers claim eligibility for promotion to warrant rank at the age of 21, and strongly object to the rule which delays selection until the age of 35. They would also like to be pensioned as warrant officers at the age of 50, which is five years earlier than is at present fixed by the regulations. The union, although it received such a severe set-back a few years ago, may still prove troublesome to the Admiralty. Mr. Allan's scheme for obtaining recruits is being warmly taken up by the Admiralty. The kingdom is to be mapped out into five engineering districts, to each of which an Admiralty recruiting agent is to be appointed. These recruiting agents, who are to be engineers, will receive regular salaries for their work, and in addition capitation grants. The scheme is to be given a twelve-months' trial.

Devonport Dockyard.

The launch of the battleship *Bulwark*, by Lady Fairfax, was the most important event at this yard during the past month. Within the last sixteen months three such vessels have taken the water from this yard—the *Ocean* in July of last year, and the *Implacable* in May of the present year. The *Ocean* has given a good deal of trouble since she commenced her steam trials, and has occasioned not a little anxiety to the officials here. On her 30-hours coal consumption trial at four-fifths full power she obtained a mean speed of 16·5 knots, with a coal consumption of 1·6 lb. per I.H.P. per hour; the *Canopus*, it may be mentioned, attained a speed of 17·2 knots with precisely the same coal consumption, whilst the *Goliath* reached 17·3 knots with a coal consumption of 1·5 lb. per I.H.P. per hour. Thus it will be seen that the *Ocean* does not compare well with her sister ships. The *Ocean's* failure is attributed by some to the neglected condition of her underwater fittings. The story of the *Hermes* being attached to the command here for three weeks for the purpose of experimenting with wireless telegraphy turns out to be an official hoax. Why the story was printed at all on official paper is not properly understood as yet, but it is believed that it was circulated to discover the culprit who communicated such tit-bits of news to the press. The *Hermes* will eventually relieve the *Talbot* on the North American and West Indies Station. She is of the same displacement as the *Talbot*, but is superior in H.P. and armament. The most interesting experiment was that carried out by the *Arrogant* recently in towing the *Ganges* from this port to Sheerness. Ordinary dockyard tugs could have done the work quite as well, but the reason that the *Arrogant* was selected for the work was probably to discover whether vessels of the class to which she belongs could undertake such work as towing disabled warships when coming to grief themselves.

The Transport Service.

The transporting of the Army Corps to South Africa has progressed with smoothness and despatch. It was the first time that such a large operation had been undertaken by the Admiralty, and out of all the ships that were sent away the only delay that occurred was that caused by the breakdown of the transports *Zibenghla* and *Zayathla*. That this was a serious delay it must be admitted, as it kept back the artillery from the Cape, but the importance of the mishap has been in many cases exaggerated. Altogether more than 80 vessels will be necessary to convey such a large body of men to South Africa, and it must be expected that a hitch will occur when such a great undertaking is in progress. The blame for the delay of these two vessels, we are told, will have to be borne by the heads of the Transport Department, but that remains to be seen. The transporting of the Army Corps has necessitated the employment of 35 naval officers, amongst whom are five captains. There is also the shipment of mules and horses from Spain, Italy, and the United States to be looked after. The transporting of the troops to the Crimea in 1854 called forth the admiration of the German military leader Moltke, but if he had been alive to-day to see the moving of over 40,000 troops, nearly 100 guns, 16,600 animals, and 2,150 vehicles to a country, as far distant as South Africa, the warmth of his admiration would have been more than doubled. The breakdown of the *Zibenghla* and *Zayathla* called forth a letter from the chairman of the British East India Co., in which he said that there was certainly no lack of supervision, inasmuch as the engineers from the Admiralty and Board of Trade, and the shipbuilding engineer of his own company inspected the engines, and the only thing that was wrong was the delay in inspecting the new furnaces. The War Office would like to have the Transport Department in its own hands, and this, it is believed, could easily be effected by a mutual friendly arrangement. It is to be hoped, however, and there is really very little chance of its coming to pass, that the transfer will not be made on account of mistakes attributed to the officials at Whitehall.

French Navy Estimates.

The French Navy Estimates for 1900 have now been prepared, and from them it appears that the exact sum to be voted is

315,012,750 francs, an increase of 11,412,240 francs upon that of 1899. The votes for naval construction amount to 120,270,000 francs, but only a little more than 2½ million francs of this amount is to be devoted to new work in the coming year. No new programme of work has been foreshadowed. With the exception of two small cruisers, all the vessels intended to be laid down in 1899 have already been commenced, or orders for their immediate construction sent out. These vessels are as follow:—Armoured cruisers, *Marseillaise* (Brest) and *Amiral Aube* (private yard); submersible boats, *Sirene* and *Triton* (Cherbourg); sea-going boats, *Bourrasque*, *Rafale*, *Boree*, and *Tramontane*, and 11 first-class boats (private yards); four destroyers. *Pertuisane*, *Escopette*, *Flamberge*, and *Rapiere* (Rochefort); vedette boat, *Libellule* (private yard); submarines, *Francais* and *Algerien* (Cherbourg); river gunboats for China, *Argus* and *Vigilante* (in England); and submarines, *Farfadet*, *Gnome*, *Korrigan*, and *Lutin* (Rochefort). A number of changes are to be made in the French Mediterranean and Channel Squadrons, and on the foreign stations a few obsolete craft will be replaced by modern gunboats. To all appearances, however, the struggle for naval supremacy which has been maintained unceasingly between this country and France for so many years past is to be continued.

Chatham Dockyard.

A great deal of overtime has been worked at this yard during the past month fitting out vessels for foreign service, and to catch up the arrears of work for the current financial year. The repairs on the *Blenheim* are being effected as quickly as possible, as it is desired to test her new armament of quick-firing guns as quickly as possible. The *Archer*, too, is to be ready for commissioning by the middle of this month, and much overtime has been resorted to in order to get her ready for this event. She is, it will be remembered, being refitted and rearmed. The *Arethusa* is also to be ready for the pennant by about the same time, when she will leave for the Pacific Station to relieve the *Leander*, a sister ship. On the 1st of next month the *Diana* is to be brought forward, and a little later the *Apollo* and *Sappho* are to be ready for commissioning. Two other vessels which are undergoing refits are the *Immortalite* and the *Imperieuse*. £30,000 are to be spent upon the first-named, and £25,000 upon the latter. The engine-room artificers attached to the steam reserve at this yard are dissatisfied with the messing and bathing accommodation afforded them on the *Pembroke*. It is said that for the 300 men on the depôt only three baths and about a dozen towels are provided in three small washhouses, so that the majority of the men have to perform their ablutions in the stokeholds and engine-rooms, or wherever they can find a convenient spot. The Amalgamated Society of Engineers has interfered in the matter, and it looks as though some ill-feeling would result. It would be as well if a little more attention were given to the comfort of this class of men, especially as there is some difficulty at present in obtaining recruits in sufficient numbers. The *Dreadnought* has at last passed into the Fleet Reserve, having completed her refit.

The Relative Importance of Guns, Armour, and Speed.

Often as this question has cropped up, it has never, and probably never will be, settled to the satisfaction of all. A reviewer in the *Engineering Magazine* deals with the question in a most lucid manner, and the conclusions which the writer arrives at are interesting. Early in the article he expresses the opinion that the battle of Santiago was not a battle at all in the accepted sense of the term; it was a chase. In this case speed is the prime factor for either side, but when it comes to a pitched battle the writer's opinion is that success depends upon manœuvring ability almost as much as anything else. This is obvious, as is also the fact that a fleet of greater speed can seldom, if ever, be forced into action by a fleet of inferior speed. The writer also remarks that, if the enemy puts on speed in order to join or combine with another fleet, it would hardly be desirable then to catch it unless guns and armour were good enough to secure victory. However, the majority of the statements are sound enough, as, for instance, when he says that: "It is most important that a squadron should be homogeneous in the matter of speed if concerted action is to be possible; that at the present time the only navy in the world that can put a homogeneous squadron into action is the British Navy; that a 15-knot squadron of homogeneous ships stands, when these are steaming together in station, to better a swifter fleet of various units, because these last will not be able to perform evolutions together at high speed; that, as a matter of fact, 12 knots is the highest speed at which fleet evolutions have yet been done, and that has only recently been accomplished; that the next trials will be made at 14 knots, but that such a speed in evolutions is only possible in a highly trained, regularly commissioned, and homogeneous fleet." The conclusion arrived at in the end is that, whilst speed is a very important qualification for all naval vessels, it must not take first place for battleships, but must come after the questions of guns and armour. It is impossible, and, perhaps, even undesirable, to put two such contradictory qualities both in the first place. The heavier vessel cannot be the swifter, nor can the swift ship be so heavily armed. Each has its place and function; and in the one, speed comes first; in the other, fighting power. The battleship should be a battleship, and the armoured cruiser an armoured cruiser.

The Launch of the "Bulwark."

A couple of weeks ago the launch took place of the new battleship *Bulwark*, from Devonport Dockyard, after having been in hand for less than seven months. She has created a record in having the greatest weight built into her in the time mentioned, and it will be some time before France, or any other nation, can complete such a feat, try as they will. She is 400 ft. long between the perpendiculars, and has an extreme breadth of 75 ft.; her draught of water (forward) is 26 ft. 3 in.; aft, 27 ft. 3 in.; whilst her load displacement is 15,000 tons. She will be fitted with two complete sets of engines of the vertical triple-expansion type of 15,000 I.H.P., and is expected to attain a speed of 18 knots. The engines have cylinders of 31½ in., 51½ in., and 84 in. diameter, and a stroke of 51 in. Each set, built in a separate room, is to be capable of developing 7,500 H.P., with 108 revolutions per minute. There will be 20 boilers of the Belleville type. The armament will comprise four 12 in. breech-loading guns, worked in two barbettes, twelve 6-in. quick-firing guns in casemates, sixteen 12-pounder 12 cwt. quick-firing guns, six 3-peunder. Hotchkiss quick-firing guns, one 12-pounder 8 cwt. boat gun, one 12-pounder. 8 cwt. field gun, and eight 45-in. Maxim guns. She will also have four submerged torpedo tubes. Her complement is 773 officers and men. The *Bulwark* and her sister ships are identical in form, dimensions, and displacement with the *Formidable* class, but differ slightly in the distribution of armour protection. In the *Venerable* class the belt of side armour is carried much nearer the bow than in the *Formidable* class, whilst the fore-armoured bulkhead, which is a feature in the *Formidable* class, has been dispensed with.

Sheerness Dockyard.

The two new sloops preparing to build at this yard, the *Fantome* and *Espiegle*, will probably be commenced before the sloops *Vestal* and *Sheerwater* are floated out. One, we are told, is to be commenced in Dock No. 4, and the other on the slip recently vacated by the *Pomone*. When these two vessels are taken in hand, there will be altogether six sloops in various stages of construction at this yard; two, the *Condor* and *Rosarie*, building; two, the *Vestal* and *Sheerwater*, which were begun on February 1st, completing, and almost ready to take the water; and the two new ones mentioned above. These are to be twin-screw vessels, so that in this respect they will differ from the other four sloops building here. One, the *Espiegle*, will be engined by contract, but the engines of the *Fantome* are to be constructed at Devonport. The machinery of the *Rosarie* was also constructed at Devonport, and the machinery of the *Vestal* is now being built there. The *Condor* is to carry out her trials next month. She is the first of the new sloops fitted with Belleville boilers. An I H.P. of 1,400 will be expected from her triple-expansion engines under forced draught, with a speed of 13·25 knots. With natural draught she will be expected to develop 1,100 H.P., with a speed of 12·6 knots. The trials of the *Rosarie* will take place a few week later. This establishment has recently been revalued for assessment purposes by officials from London, and the total value has been put down at £13,747. The *Speedy* is to be transferred to the A division of the Medway Fleet Reserve, pending the decision of the Admiralty to employ her on active service.

Trafalgar Day.

About a week ago the 94th anniversary of the victory obtained by Lord Nelson over the French at Trafalgar was celebrated in London and the provinces as well as at all the great centres throughout the Empire; in fact, several of the Colonies had the day specially selected for the departure of the volunteer contingent bound for the Cape. The day afforded opportunities for displaying Imperial sentiment, which was taken full advantage of in London, for Trafalgar Square was, for nearly a week, literally packed with visitors intent on viewing the decorated monument of Nelson. The Navy League authorities, who were responsible for the decoration of the column, had had it festooned from top to bottom with thick cords of laurel wreaths lit up in the evening by electricity, and the base of the column was lavishly decorated with wreaths from all parts of the world. There were several wreaths on view from the descendants of the men who fought at Trafalgar. At the Royal United Service Institution, a most interesting exhibition was held of miniatures, relics, and trophies connected with the life of Nelson, and was visited by hundreds of people. The anniversary was also celebrated in suitable manner on board the *Victory* in Portsmouth Harbour. Nelson's signal, "England expects that every man will do his duty," was hoisted in this ship for the first time since the battle of Trafalgar, and laurel wreaths were suspended between each of the *Victory's* masts, and one was placed on the spot where the great admiral fell. The majority of the daily papers, in referring to Nelson's signal at Trafalgar, make it "England expects every man to do his duty," which is, of course, incorrect. The proposal to establish a Nelson Museum on the *Victory* has met with success, and a deck-house will probably be built to accommodate the large collection of Nelson relics and memorials. The idea of housing in the upper deck, as in the depot ships, has been abandoned.

Pembroke Dockyard.

Work at this yard is now in full swing under the new Superintendent. It is noteworthy that just before Rear-Admiral Burges Watson relinquished this post he issued the following minute:—"I wish to thank the officers and men of this dockyard for their loyal support, and to express my satisfaction at the way the work has been done from the time I have been in charge." Overtime has been resorted to in order to assist the progress of the new Royal yacht, and shipwrights have been transferred from the *Essex* to work on her. The trouble about the non-inflammable wood has not yet been properly overcome, and the opinion prevails that it would have been much wiser to have used ordinary wood. It is rumoured that in April next Captain the Hon. Curzon-Howe will relieve Rear-Admiral John Fullerton in the command of the Royal yacht. Failing health is the cause attributed to Sir John's desire for retirement. The new yacht is to be hurried forward as much as possible, and instructions have been given to use all possible expedition in completing the work in the interior of the vessel, even at the expense of other branches of work in other parts of the yard The *Essex* is practically at a standstill, and as regards the *Spartiate*, the progress that is being made at present upon her is not very great, and she will not have any extra hands at work upon her until the departure of the Royal yacht.

The late Admiral Colomb.

The sudden death of Vice-Admiral Philip Howard Colomb has deprived us of a thinker and writer on naval subjects second to none, and a man who has probably done more towards bringing before the country the true conditions of national defence than any other naval writer. He will also be remembered as the originator of the idea of flashing night signals, which, in one form or another, are now used in nearly every navy in the world. Several appreciative tributes to the deceased have been published, notably in the *Times* and *Army and Navy Gazette*. The latter says:—"We are appreciably poorer than in the recent day in which we knew that a keen and vigorous intellect was ever awake to detect a flaw in the reasoning or policy of those who direct the naval affairs of the country, or in the arguments of those who are, or claim to be, the instructors of the people in the things that should be its most serious concern." Admiral Columb saw service in all parts of the world during the time he was on the active list, being compulsorily retired on account of age in 1886. His signalling invention, although practically completed in 1861, was not finally adopted in the Navy until 1867. He recently remarked to a friend that, in his opinion, the Marconi system of wireless telegraphy would before long entirely supersede the system with which his (Admiral Columb's) name was associated. Admiral Columb lectured for many years on the subject of collisions at sea and how to prevent them, his views being finally adopted in principle by the National Convention at Washington in 1889. He produced under official authority, in 1874, the new "Manual of Fleet Evolutions," and in 1891 his elaborate and extensive work on "Naval Warfare" appeared, "In which," says the *Times*, "almost for the first time in modern naval literature, he enunciated and illustrated from history the true principles and conditions of sea power and its exercises." "His memory," says the *Army and Navy Gazette*, "will ever be honoured for the unflagging zeal and lucid discernment with which he sought out and made conspicuously clear the supremely important teachings of our naval history."

Gunnery in the French and English Navies.

The publication of the official gunnery return, showing the results of the target practice carried out by the ships of the French Mediterranean Squadron, has given rise to some unfavourable comparisons being published between the British and French naval gunnery. Facts can be made to prove anything, although the return in question does not need a great deal of study to prove the superiority of British over French naval gunners. It is not well to be too optimistic and to assert in an all round manner that British gunners are superior to those of all other nations, for that is the surest way to lull people into the belief that special exertions towards accurate shooting are necessary, and gunnery practice can never be too good. French shooting has certainly improved, and efforts are being made to make this department of the Navy still further efficient, but in the French returns neither the size nor shape of the targets is given, nor the speed at which the vessels steamed whilst firing. Out of all the ships engaged, the number of shots fired was 1,321, out of which 600 hits were made, the average time of a shot being 23 seconds. The best average was that attained by the crew of the *Cassard*—72 per cent. of hits in nine minutes—and the lowest average that of the *Jemmapes*, which only managed to get on to the target five times with 24 shots, which took a quarter of an hour to fire. The pay of English captains of guns and turrets may not be as high as that of the French Navy, but it is extremely problemmatical if the *esprit de corps* of the latter in any way approaches that of the British gunners. The news, however, that French gunners are improving their shooting will most probably lead to further effort on the part of our own men.

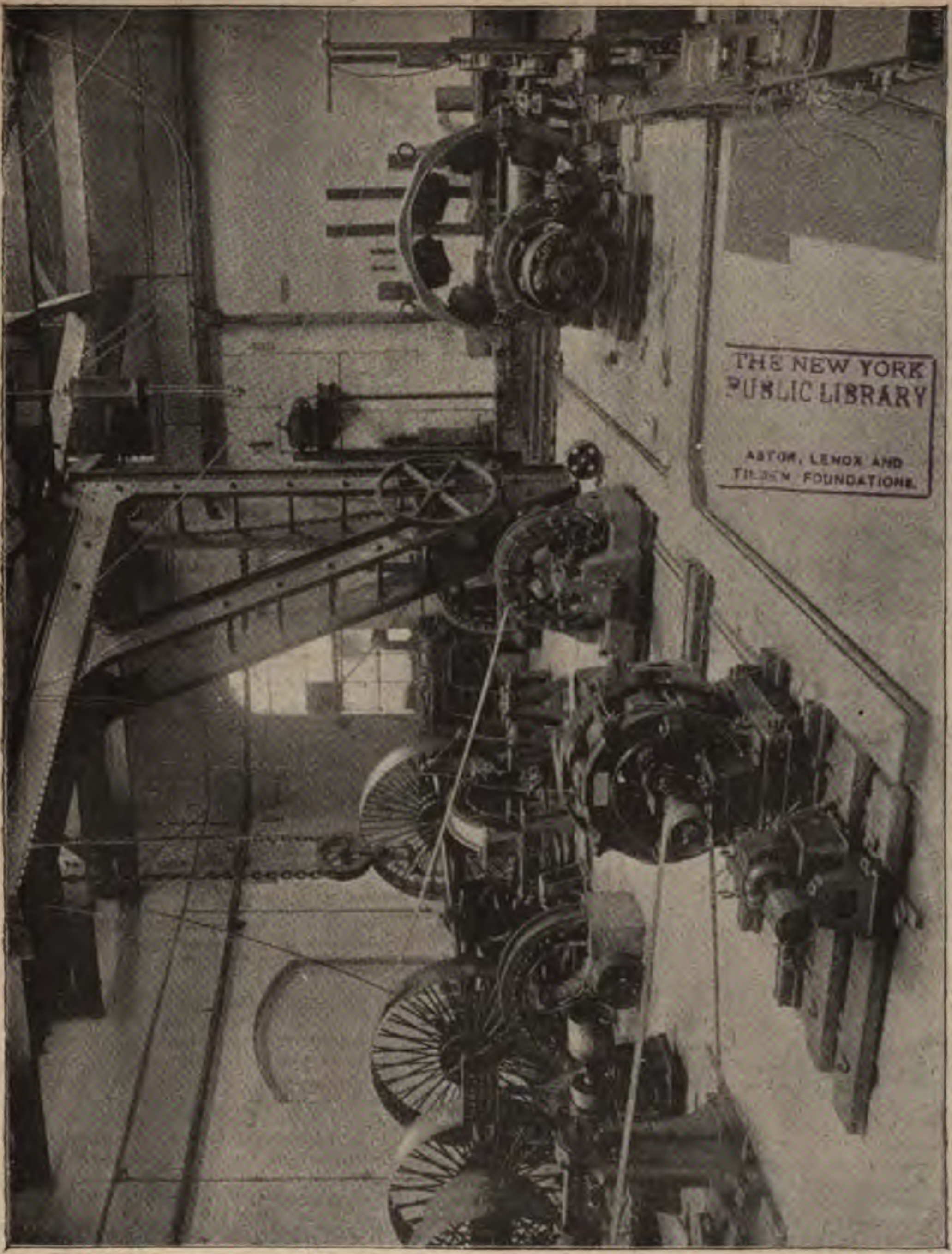
JOHNSON & PHILLIPS.

THIS firm is at present building additions to its works, especially in the cable manufacturing department. Like many older works about London which have been built up by degrees and in consequence of the energy of one man the shops are considerably spread about Old Charlton.

The chief controlling mind of the establishment is Mr. Johnson. He was articled as an apprentice to an English locomotive works. Afterwards he applied himself to the study of science at King's College, London. When he had finished he applied himself to cable laying, and now he manufactures most of the machines for use in the construction of cable.

It was in 1875 that he, along with Mr. S. E. Phillips, decided to start a little factory for the construction of electric machines, and they did so at Charlton, in Kent. Gradually, bit by bit, it rose until the partners found their premises so far extended that they had to pay £30 a year. Now that rent only represents the rental of one of the very smallest workshops which goes to make up the establishment.

The work of the establishment is by no means confined to cable making. There is a large electrical meter manufacturing shop. And another where huge central station dynamos are built. Mr. Johnson is also the principal shareholder in the "Dujardin-Planté Accumulator," which is better known as the D. P. Battery, and he is managing director of the company. He also owns and works two gold mines in Dolgelly, Wales. This might be sufficient scope for any man's energy, but it is not for Mr. Johnson. He



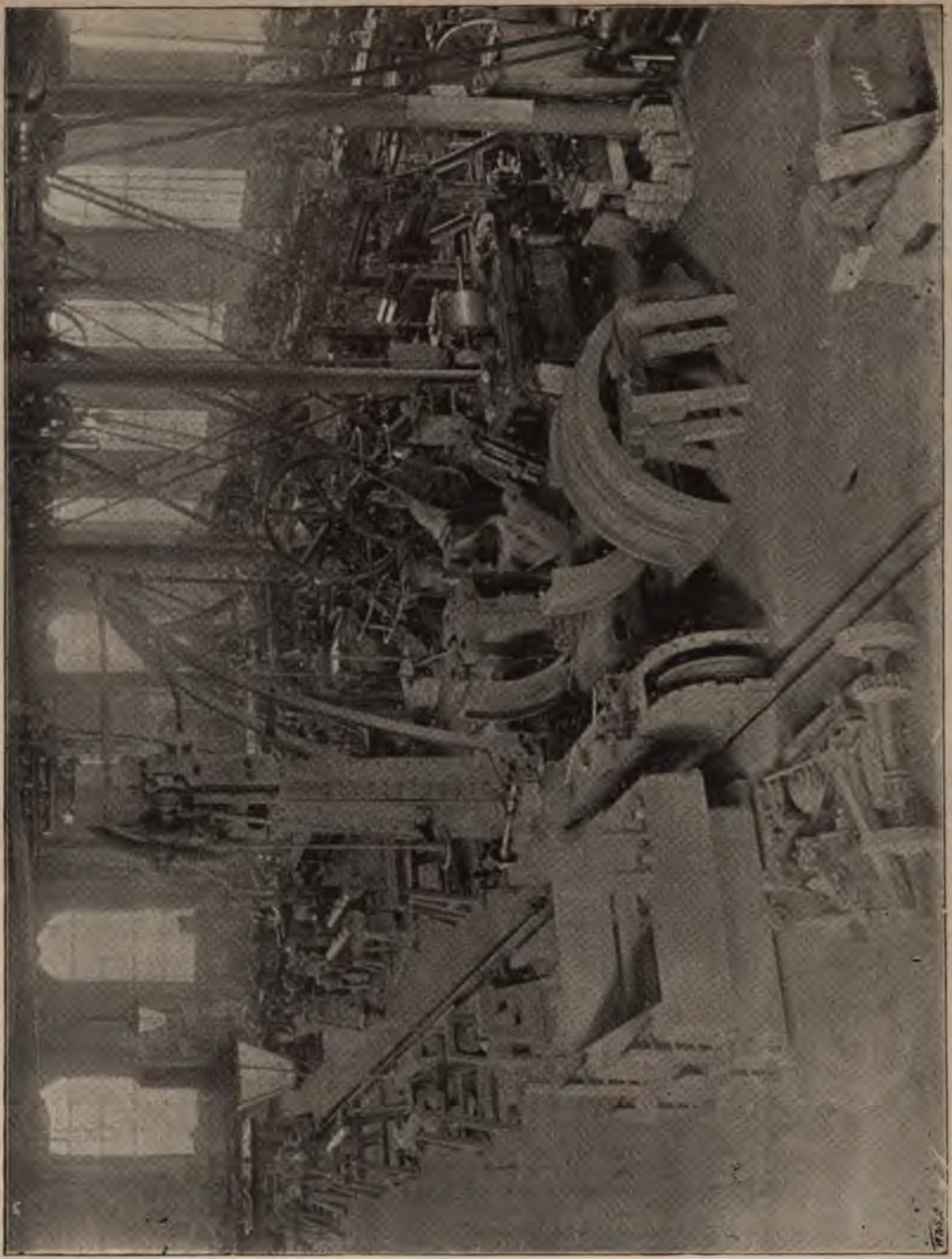
THE NEW YORK PUBLIC LIBRARY
ASTOR, LENOX AND TILDEN FOUNDATIONS.

Dynamo Testing Shop, Messrs. Johnson & Phillips. Fig. 1.

is also the leading director of the Electrical Development and Finance Corporation, a director of the Bell's Asbestos Co., and a director of both the British and Continental Jandus Arc Lamp Co.s.

One of the principal manufactures of the works is the gear for dealing with submarine cable. They constructed the gear for paying out and picking up the cable for the Japanese Government cable steamer *Okinawa Maru*, and also the gear accessories and stores for the *Tutanekai*. They have also fitted a merchant vessel as a cable-laying and repairing steamer with all necessary cable tank accessories and stores, for the French. There is a huge shop full of cable making machines all engaged in the construction of large cables. And in the same yard another shop which is worked with boys. This shop is used for dealing with the insulation of smaller electric wires.

Across the road is another large shop for the manufacture of the Johnson and Phillips's arc lamp. It is used in Government departments, the post and telegraph offices in London, Birmingham, Manchester, Glasgow, Leeds, Hull, and other places, and for street lighting in the following, amongst other towns:—London, Oxford, Dublin, Brighton, Edinburgh, Tun-

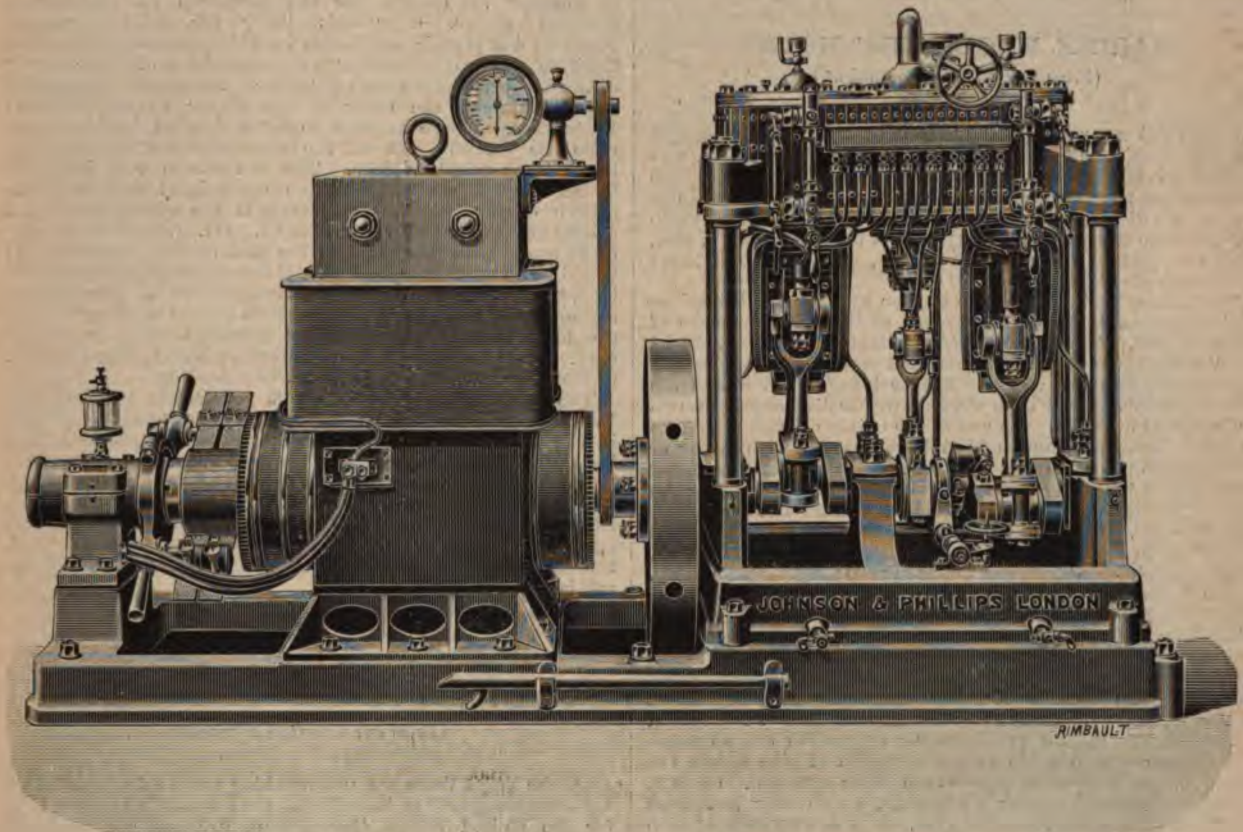


MACHINE SHOP, MESSRS. JOHNSON & PHILLIPS, FIG. 2.

bridge Wells, Bristol, Portsmouth, Stafford, South Shields, Blackpool, Aberdeen, Londonderry, &c. Over 20,000 of these lamps are in use.

To marine engineers the main interest in the works are the sets of combined engines and dynamos for ship electric lighting. We show an illustration Fig. 3 of a combined set—a direct coupled Johnson & Phillips's dynamo with a Bellis open engine. There is also their well-known alternator. In this the armature which carries the high pressure current is stationary, and is not thus subjected to centrifugal strains. Also the armature coils are furnished with laminated iron cores, to which they are securely attached, these cores being independently bolted to a cast-iron ring, and the whole forming a strong mechanical structure. In this feature the design is considerably superior to machines which have long and narrow coreless coils with only a fixing at one end, which have proved unsuitable for prolonged work under racking strains. Each coil is independent, and can be replaced in a few minutes without touching the adjacent coils, and without any preliminary preparation. The construction also admits of increasing the thickness of the insulation between the coils and cores to any required extent without any addition to the air space, or increase in magnetising force. By reason of the excessive insulation which can be employed the breakdown of a coil to frame is a thing unknown. The coils are not endangered by reduction of clearance, which may result from some of the journals, as there are no conductors in the air gap.

The armature circuit is terminated in two gun-metal blocks mounted on a plate of insulating material fixed in a convenient position on the machine. These terminals are furnished with a protecting cone so that nothing may accidently touch them.



Ship Lighting Set, Messrs. Johnson & Phillips. Fig. 3.

The exciting current is conveyed to the field by a double set of brushes resting on two contact rings of gun metal, mounted side by side, on, and thoroughly insulated from, a substantial cast iron bush, which in turn is kept upon the shaft. The brush-holders are provided with suitable terminals to take the conductors carrying the exciting current.

The transformer made by the firm is characterised by great simplicity of construction, the proportions which have given such good results having been suggested by long experience. The iron used for the cores is the best. The drop in both from no load to full load is small. Great care has been taken with the insulation. The primary and secondary coils are wound in separate cylinders of hard and indestructible materials, and have, when placed concentrically on the core sheet, ebonite interposed between them. This method of insulation is so perfect that a breakdown between primary and secondary or between coil and core is unknown. The apparatus is enclosed in a cast-iron watertight case provided with gunmetal ebonite bushed glands for both primary and secondary conductors. There is no fixing whatever in the case, so the transformer when the core is removed can be lifted out bodily if desired. The transformers are made in all sizes.

In the transmission of power plants, they are rather famous, being the first to successfully cope with long distance transmission. The power house was situated on a river where three turbines working under a 30 ft. fall furnish power through countershafting to these two-phase alternating current generators, and then direct current exciters. The pulleys on the countershaft are each provided with clutches, so that one or other generator or exciter can be readily stopped without shutting the pressure off the main. Each machine has a capacity of 175 E.H.P. and runs at a speed of 400 revolutions per minute. The machines generate two currents in quadrature at 3,300 volts p. d., with 6,000 alternations per minute. There is a complete system of self-lubrication. They are also the original inventors, patentees and sole makers of the fluid insulator, and it has been reported that even with a pressure of 2,000 volts, delicate means of observation have been able to discover only a trace of leakage.

The number of men employed by the firm is about 600. Mr. Johnson appears to have the faculty of instilling in his assistants and men an interest in the business, and especially is this shown in the secretary, Mr. Hughes. His conversation and manner would lead one to believe that the success of the firm is very much a matter of his concern. And he appears to inspire in his assistants similar views of their duties to the welfare of the firm.

We illustrate two views of the shops. The dynamo testing shop is shown in Fig. 1, and the machine shop in Fig. 2.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

A PAPER was read at the Institute of Marine Engineers on the subject of "Feed-water Filters." The paper was written by Mr. Walter W. Houfe (member). The paper was the result of the experience of the writer during the last five years. He divides the objectionable matter which may get into the feed into two classes: 1. Oxygen and carbonic acid; 2. Oils, fatty and mineral and abraided metals, packings. The latter division he classifies as dirt.

The author is of opinion that oxygen and air of themselves will not cause continuous corrosion without the presence of carbonic acid. Along with the air and carbonic acid he thinks that hydrochleric acid will be formed from the decomposition of magensic chloride, and the former being 1½ times and the latter 1¼ times heavier than air, both will be discharged through the hot well overflow. He was of the opinion that it would be better to have the pumps inlet kept covered with water or drowned, and to effect this had an automatic float made, but could not claim any advantage from this arrangement over the plan of preventing everything being admitted but feed water and pure air. He thinks that the presence also of internal feed pipes in the boiler was an important factor. The author gives the opinion of Sir John Durston as to the grease difficulty. "The whole of their troubles came from grease. He did not think there was a filter which was of any use whatever." He next deals with exhaust steam separators, and points out that one American firm found that "it is essential for exhaust steam filters to have their inner surfaces wet, and the steam saturated steam." They used a jet condensing spray in their exhaust steam separators. Filters he classifies as follows:—Class 1. Those having special provision for separating out as much "dirt" and oil as possible in consideration of size before the water comes into contact with the filter medium. Class 2. Those not possessing such a chamber, which may be termed the common medium chamber type. He came to the conclusion that the filtering material which had to arrest dirt should not be expected to stop grease, since the dirt soon clogged up the material. He proposes that there should be a separating chamber, which should have a practically constant water line, and contain a considerable quantity of water, so that the heavy matter may fall to the bottom of it, and the light oil rise to the top. The author tried one, and after a few days' working there was considerable deposit at the bottom and scum of oil at the top. A plan adopted by someone was to take a barrel and divide it down the middle with a board not quite reaching the bottom, then filling it with sponges, and allowing the hot water to pass through the sponges down through the bottom and up through the sponges on the other side. A great quantity of oil was syringed out of the sponges. The second class of filters are closed to the atmosphere, and provide means for drawing off oils and solids. They are objectional when they are made to work in both directions, since the filtering material is reduced to a pulp. For the filtering material, he says, woollen fabrics are disapproved of on account of shrinkage and imperviousness to water, cotton materials rot easily, and pure flax is the only material that gives satisfaction. The author inclines to the use of Turkish towelling. He finds that two thicknesses give good results when under a pressure of about 12 in. of water. With regard to media arrangements, he classifies them under different headings:—(1) Mass media; (2) horizontally placed media; (3) vertically placed media; (4) angularly placed media. The latter three are exclusively of the cloth type. In the first kind he thinks the inlet ought to be at the top and the outlet at the bottom. With horizontally placed media the media assists itself to frustrate the object of the filter. With vertically placed media the motion of the water to the top unobstructed should allow the oil to rise to the surface easily. With obliquely placed media there is partial obstruction to flotative force. The Admiralty have several filters with media placed at 45 deg. It was the opinion of Mr. Hulme that the above kind of filter was of little purpose. That grease-oil and solid matter were skimmed easily from the surface of the fire water heater, and that solid matters precipitated themselves out as the temperature of the water rose in the heater. The dinner of the institute takes place next month, and there is another at Cardiff for the members of the British Channel centre. Over this latter Sir John Fortescue Flannery will preside, and it may be said that no president of the institute was more attentive or more solicitous of the interests of the institution than was Sir John. Sir James Mackay, of course, occupies the chair at the dinner at the Holborn Restaurant. There appears to be a decided inclination to raise the institute out of the little club feeling, and lay its basis on scientific lines. The institute is very fortunate in securing a gentleman of the educational and scientific calibre of Mr. Boyle. Mr. Boyle is the embodiment of a cause, not of ambition for himself. Mr. Lawrie is another force whose presence is all to the good of the institution, It would be an advantage, however, if the meetings were attended by a greater number of the members of council. Surely some arrangement might be made whereby a certain number of them should be present at each of the meetings when papers are read. And what has come of Alderman Kidd? His presence in the chair was wont to make a lively meeting.

The work in the laboratory is proceeding satisfactorily. Further experiments have been made on the effects of circulation in the evaporation of water; and very curious results indeed have been obtained; results which might have been foreseen, but which are contrary to all accepted views on the matter. Messrs. Sir M. Samuel & Co. have, through Sir John Fortescue Flannery, sent a cask of oil fresh from the Borneo Oil Wells to be experimented with. And there is a Capell fan being sent to the institute to be experimented with. The results of these will be given in due course.

ELECTRICAL NOTES.

(From our own Correspondent.)

ON the Volga there are now working suction dredgers whose motive power is electricity. One named the *Beta*, built for the United States Government, dredged and removed 7,800 cubic yards in an hour. Another dredge, built for the Volga, is in two parts, and can be worked separately. Each half measures 216 ft. by 31½ ft. wide and 9 ft. deep. At light draught the hull draws 4 ft., the working draught being 8 in. greater. When worked as a whole she is 62 ft. wide. The electric installation consists of a 600-kilowatt generator directly connected to a fore-and-aft triple-expansion engine. It supplies two stern motors and two bow motors, each of 125 H.P., actuating 4-ft. screw propellers. The generators also supply power to two 30-H.P. motors, mounted in the distributing pontoon and arranged to control the position of the pontoon line. The lighting of the dredger is done separately. The control of all motors is centralised in the pilot house. Quarters are provided for the crew and Government engineers on each hull. Each pair of compound cutter engines works four cutters. Each main pump engine can develop 1,500 I.H.P. The tender is a stern-wheel steamer with a speed of 10 knots an hour. There is a main centrifugal pump in each half. The runner is of cast steel, and the shaft is a steel forging, and makes from 150 to 180 revolutions per minute, and it is driven by a divided vertical triple-expansion engine, two cylinders being on one side of the pump and two on the other. The dimensions are:—High pressure, 21 in. diameter; intermediate pressure, 34 in.; low pressure, 39 in.; stroke, 24 in.; I H.P. from 1,425 to 1,600.

The engine weighs, complete, 45 tons. The engine driving the electrical generator is of the usual vertical marine type triple-expansion, three cylinders working on three cranks. The dimensions are: High pressure, 14½ in.; intermediate pressure, 22¾ in.; low pressure, 37⅜ in.; stroke, 24 in. The diameter of the main shaft is 7⅜ in.; I.H.P., 800; revolutions, 200 per minute, and weight 25 tons. The cutters are driven by means of a pair of horizontal, tandem compound engines placed side by side, with shafts coupled together to quarter cranks. A 10 in. centrifugal pump provides the circulation in the surface condenser. The boilers are of the Babcock & Wilcox type, of which there are four in each section; the total heating surface of the eight boilers is 17,200 square feet. They are fired with naphtha. There are four burners to each boiler in the dredger and two to each in the tender. At the full power trial the evaporation was about 8 lbs. per square foot of heating surface. The temperature of the funnel gases was about 500 deg. Fahr. In the pilot-house is a stand of levers for operating the friction clutches and brakes of a four-drum hoist below the steam valve of the hoist and the reversing gear. From the same place are operated the steam and trolling gear of the engine driving the cutters, and so everything is under the control of the engineer. There is also within reach a complete system of signal and alarm bells, with cords to three steam whistles, speaking tubes, and a telephone to the end pontoon. At the sides of the room are the switches and controllers for the electric motor. At the rear of the room is a marble panel switchboard, rheostat compensation, and other electrical appliances. For night work there is an electrical projector, or searchlight, above, which is controlled from below. In each hull is a 600-kilowatt, 550-volt, 24-pole generator driven by an 800 I.H.P. marine engine, running at 200 revolutions, and giving a frequency of 40 per second. The current is led to four motors in the dredger and two in the end pontoon. The pontoon motors are 30 H.P. each, have 10 poles, and run at 480 revolutions, with three shafts directly coupled to a four-bladed propeller 20-in diameter. The exciter is a 15-in. kilowatt, marine set, but it also supplies current for a searchlight on the roof, and for about sixty 16-candlepower incandescent lamps which light the dredger. There is an oil barge which carries six tanks of oil, having a total capacity of 130 tons, and it is 80 ft. long with 20 ft. beam, with load draught of four feet.

Electric Power in Engineering Works.—It will be interesting to those with large shops through which power is distributed to considerable distances, to learn that with central plant for electrical distribution, the amount of power for a given output is very considerably reduced, and by electric driving of special tools, the labour item in the cost of manufacture is reduced, and that special electric procesess and electric lighting improve the output by bringing about a better general *morale* of the shop.

Marconi Wireless Telegraphy at the Yacht Race.—The installation for this was fitted in the steamship *Ponce* which followed the racers. The foremast of the ship was lengthened by a spar lashed to it, so that its highest point, to which was attached the upper end of the vertical signal, was 140 ft. above the water. The apparatus consisted of an induction coil about 12 in. long, having an ordinary hammer interruptor, some 30 or more very large cells of dry battery, a key in the primary circuit of the coil, and the receiving mechanism. The vertical circuit consisted of a bare No. 10 copper wire hanging from an insulator on the masthead, and running through a section of ordinary rubber hose where it entered the door of the charthouse. The spark was about ½ in. long. The terminals of the coil, brass balls about an inch in diameter, were respectively connected to the vertical circuit described above and to the hull of the ship. When signals were to be received the sending apparatus was disconnected, and the receiving colures and its Morse receiver connected. More than 2,000 words were sent during the race. In the Commercial Cable Co.'s cable ship, anchored near Sandy Hook lightship, a set of Marconi instruments was installed in charge of Mr. L. Bowden, of London. The messages were sent at the rate of about 15 to 16 words per minute. The longest distance of transmission of course was when the yachts were at the furthest stake boat 15 miles away.

Submarine Telegraphy in the Navy.—Considerable difficulty has been experienced in obtaining suitable instruments on board ship to work submarine cables. Most of them require an expert telegraphist to make the signals. Mr. Sullivan, the inventor of the Sullivan galvanometer, has been giving his attention to the matter, and has simplified it so that it may be used by the ordinary operator with success. There are two ways, says the *Electrician*, for damping down the swing of the needle of the galvanometer. One is the electromagnetic damping due to the closed circuit of the metal coil on which the coil is wound nearing the magnetic field of the permanent magnet, and the other is a camel-hair brush laid against the phosphor-bronze strip on which the coil is suspended. The latter is only used when the galvanometer is being used as a "speaking" instrument, offering as it were a static friction, so that the coil does not start moving until the current has attained a certain value, and produced sufficient turning moment. This results in a sharper and quicker swing, compensating for the decrease in amplitude. The static friction is also increased by adding a second brush, so that there is a camel-hair brush surrounding the suspension on either side of the coil. A third modification is to increase the breadth of the strip, thus making the galvanometer far more robust than its predecessors, and likely to be unaffected by rough treatment that would completely destroy the suspensions of ordinary galvanometers.

The instrument has been tested in one of the Atlantic cables 3,000 miles long, and the signals were quite distinct, By adjusting the camel-hair brush, the signals can be made quite dead-beat. It can also be made to work directly on the cable without a condenser, or even a sending switch. By adjusting the suspension the operator can vary the sharpness to correspond to those given by short distances and long distances of cable.

H. E. Moss & Co.'s Steamship Circular.—Liverpool, October 24th, 1899.—In our last semi-annual Steamship Circular we expressed a belief that this would be a satisfactory year for shipping and all kindred trades, and these anticipations have been fully realised. In fact, the views of the most sanguine have been more than fulfilled, and we feel sure that for some considerable time yet the present prosperity in shipping is likely to continue. Our Board of Trade returns prove most conclusively that trade in general is increasing by leaps and bounds every month, and not only is it so with us, but also with Continental countries and the United States; and, though the amount of tonnage that has been added to the register of late years is large, we must not overlook the fact that, after allowing for losses, &c., it is fully justified by the general increase in population, and the development of trades, especially with the Far East, that were not before thought of. The demand for all classes of steamers is still great, and ready vessels especially are being very quickly disposed of at enhanced prices. Values of new and second-hand tonnage have increased this year at least 10 per cent., and those owners whose forethought and enterprise induced them to buy or contract ahead have realised very handsome profits. We are of opinion that even higher prices will prevail for some time yet, as shipbuilders, with few exceptions, have sufficient work to keep them going for at least twelve months, and in many cases even longer, and if, therefore, orders for cargo steamers are not being placed as freely as before, we do not think it will very much affect builders' prices. Present prices for building ordinary cargo steamers of say 7,000 tons deadweight, with fair power, average about £8 per ton, or 5,000 tons about £8 10s. to £8 15s., and 3,000 tons £9 to £9 10s. As we write this the aspect of affairs in the Transvaal is very serious, and war, unfortunately, has been declared against us by the Boers. Many of our manufacturers who deal with South Africa have suffered serious curtailment of their orders, and in the ordinary way we should expect this to reflect upon the prosperity of shipowners as well; but the loss in ordinary freight carrying has been much more than compensated by the large number of vessels, liners and others, which have been taken up by the Government for the transport of troops, stores, &c., amounting to over half a million tons; thus creating a great demand for tonnage in all directions, not only for purchase, but for charter. War with the Transvaal, disastrous as it must be, can only have one ending, namely, the predominance of Great Britain in South Africa; and with a return of confidence which such predominance will bring, we anticipate an unexampled boom in South Africa, from which we think the shipping trade will benefit materially, and we hope permanently.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from September 26th to October 25th, 1899:—

Baker, A., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Banister, C., engineer (in lieu of a chief engineer), to the *Pembroke*, for the *Niger*, to date October 5th.

Barber, J., staff engineer to the *Pembroke*, for the *Apollo*, to date October 12th.

Bardwick, W. W., chief engineer to the *Rodney*, for the *Sheldrake*, to date October 5th.

Beckett, W. H., chief engineer to the *Duke of Wellington*, for Portsmouth Yard, as second assistant to chief engineer, to date October 11th.

Berry, R. (probationary) assistant engineer to the *Melpomene*, to date October 18th.

Blakeman, M., chief engineer to the *Australia*, to date October 12th.

Bone, H., engineer to the *President*, for service at Admiralty, as assistant engineer, acting first class, to date October 11th.

Brown, A. R. (probationary) assistant engineer to the *Illustrious*, to date September 27th.

Brown, T. F., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

Butler, F. A. (probationary) assistant engineer to the *Arethusa*, to date November 14th.

Crowle, J. N., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Elgar, G. H., assistant engineer, to the *Vivid*, supernumerary, to date September 19th.

Frost, J. J., fleet engineer, lent for transport duties at Liverpool, to date October 2nd.

Garwood, H. T., engineer to the *Terror*, for the *Rocket*, in lieu of chief engineer, to date October 19th.

Gibson-Sugars, J. S., chief engineer, lent for transport duties at Liverpool, to date October 2nd.

Gibson-Sugars, J. S., chief engineer to the *Pembroke*, for the *Pioneer*, to date October 12th.

Graham, J. E. D., fleet engineer to the *Duke of Wellington*, for the *Imperieuse*, to date October 2nd.

Grant, A. R., engineer to the *Vivid*, as assistant to chief engineer for charge of drawing office at Devonport Yard, to date October 11th.

Grant, W. C. G. R. J. (probationary) assistant engineer to the *Pembroke*, supernumerary, to date September 29th.

Gregory, C. W., staff engineer to the *President*, for service at the Admiralty on staff of Director of Dockyards, to date October 11th.

Haddock, S. G., chief engineer to the *Pembroke*, for the *Audacious*, to date October 17th.

Hammond, H. T., fleet engineer to the *Victorious*, to date September 23rd.

Hicks, J. A. H., staff engineer, lent for transport duties in Thames district, to date October 2nd.

Highton, F. W., staff engineer to the *Vivid*, for Devonport Yard, as first assistant to chief engineer, to date October 11th.

James, C. J., chief engineer to the *Pembroke*, additional, to date October 12th, and afterwards to the *Arethusa*, on commissioning, to date November 14th.

Knight, G. G., engineer to the *Duke of Wellington*, for the *Spitfire*, in lieu of chief engineer, to date October 19th.

Lister, F. H., chief engineer to the *Pembroke*, for service in that yard as second assistant to chief engineer, to date October 11th.

Maudling, W. J., fleet engineer, lent for transport duties in Thames district, to date October 2nd.

Maxwell, J., engineer to the *President*, for service at the Admiralty as assistant engineer, second class, to date October 11th.

McGregor, W., engineer to the *Terror*, for charge of torpedo boats, engine room stores, and torpedo sub-depot, to date October 19th.

Moysey, J., fleet engineer to the *Duke of Wellington*, for the *Active*, to date October 12th.

Murray, G. W., engineer to the *Duke of Wellington*, for the *Hornet*, undated.

Paris, V. de, engineer to the *Pembroke*, for the *Porcupine*, to date October 17th.

Parrott, J. W. A., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.

Pearce, T., assistant engineer to the *Arethusa*, to date November 14th.

Rayner, A. E. E. (probationary) assistant engineer to the *Hermes*, to date October 5th.

Read, A. T. P., engineer to the *Tamar*, for charge of engineers reserve stores, and to assist the Inspector of Machinery at Hong Kong, to date October 10th.

Rider, S., engineer to the *Wildfire*, as assistant to chief engineer, for charge of drawing office at Sheerness Yard, to date October 11th.

Thornhill, E. C., engineer to the *Jason*, in lieu of chief engineer, to date October 19th.

Toman, R. W., chief engineer, lent for transport duties at Liverpool, to date October 2nd.

Torrance, W. S., assistant engineer to the *Benbow*, to date October 12th.

Ward, J. T. H., chief engineer to the *Pembroke*, for the *Cossack* to date October 12th.

White, W. H., fleet engineer, has been placed on the retired list, with permission to assume the rank of inspector of machinery.

White, W. W., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE continued high prices of material, conjoined no doubt to the unsettling effect of the Transvaal war and its unknown possibilities, have been influences at work deterring shipowners from entering into any new contracts, with the consequence that hardly any order worth mentioning has found its way into the books of Clyde shipbuilders during the month of October, or as much of it as has passed at the time of writing—25th ult. Doubtless builders themselves, in the circumstances, have not seen fit to be very tempting in their responses to the inquiries as to fresh tonnage which have been made, and many of them are still too much taxed in getting on with the work they have on hand. The wilful loss of working time by workmen and the irregular delivery of material by the steelmakers have continued to be fruitful sources of annoyance, especially to the firms doing smaller classes of work. By many of these firms the system of weekly pays is felt to be anything but an advantage, however it may suit their employees generally. The working hours of the unsteady class of artisans are found to have become much less under the weekly pays. With money in pocket every Saturday too many members of the black squad have seen fit to make every Saturday a "wet" one, and Monday, in consequence, has been more or less an off-day. In one yard it is said that, in a week of 54 working hours, the average amongst the men is 35 hours per man, against 46 hours in the days of fortnightly payments. The smaller yards and shops, however, suffer most, and a change in the system is likely to be made at the end of the period of experiment.

In connection with the agitation for a further increase in wages amongst the steelworkers of the West of Scotland, it was intimated at a meeting of the Glasgow Trades Council on the 18th of October, by Mr. John Cronin, that the blast-furnacemen, about 4,000 in number, who had been organised within the last twelve months, had had a meeting through their delegates at which representatives of the manufacturers had attended. The conference was of a conciliatory character, and the employers had promised an answer within eight days. It was agreed to form a Conciliation Board for the regulation of disputes. The workers, it was stated, had received 35 per cent. of an advance since January. The men employed in steel manufacture had applied for 5 per cent. advance. They had received 25 per cent. advance since January, but they thought they were entitled to this 5 per cent., and believed that in view of the state of trade they would get it.

The outstanding direction in which shipbuilding activity has been evinced for the greater part of the month is in connection with the outfit of merchant ships chartered by the Government as transports for troops and munitions of war for South Africa. The Allan liner *Mongolian*, the City liner *City of Cambridge*, and the Castle liner *Kildonan Castle* have all been transformed from ordinary mail and passenger steamers into transport ships for troops within the month.

Fairfield Yard has created several records in connection with smart shipbuilding, but perhaps one of these, of which in the future the officials and workmen of that great establishment will be as proud as any, is the conversion within eighteen working days of the magnificent Castle liner above named from a mail steamer into a transport vessel capable of carrying 2,700 men, besides officers and full equipment—the largest troopship that has been requisitioned during the present crisis. When chartered by the Admiralty the *Kildonan Castle* was within a month of being completely finished, but all the fittings, including the first and second class passengers' accommodation, were speedily removed and the less elegant, but still elaborate and substantial, fittings for troop accommodation substituted. The accommodation provided was for 110 officers of the first-class berthed amidships, and 80 of the second class, berthed aft. On the main and lower decks accommodation was provided for 2,500 men, a place for each individual soldier, hammock hooks overhead, fittings for equipment of all kinds, provision rooms, canteens, hospitals, and dispensary, prisons and guardroom. Cooking accommodation was provided for 3,000 men, also baths, and a service of water throughout. The whole work of transforming her into a troopship kept 3,000 men employed night and day for eighteen days.

The Fairfield establishment progresses steadily with its naval work. The first-class cruiser *Cressy*, of 9,800 tons displacement, is approaching the launching stage, and she will be put into the water in the course of a month or so. A larger proportion of work than usual is being completed before she is sent off the stocks. Her sister ship *Aboukir* is plated and about to receive her outside sheathing. The name of the mighty 14,000-ton cruiser, for which the order was only given some months ago, and operations on which were practically only begun six weeks since, has already over 1,000 tons of material worked into her. Her name, by the way, which was at first intended to be the *Africa*, has recently been changed by the Admiralty to *Good Hope*.

A noteworthy feature in the hull structure of the *Cressy*, which is soon to be launched, is the Harveyised armour plating manufactured by Messrs. William Beardmore & Co., of Parkhead Forge and Steel Works. This enterprising firm have for a few years past supplied 6-in. armour plates of their special Harveyised manufacture for casemate and other purposes on board warships built on the Clyde and in the Government dockyards, besides supplying foreign Governments; but the *Cressy* is the first vessel in which the Parkhead plating has been worked so extensively into the regular armour-plating scheme of the hull of a naval ship for our own country. Hitherto, of course, Clyde builders of naval ships have had to resort to the great armour-making firms of Sheffield for most of their requirements in the way of heavy armour plating. The exception in the case of the *Cressy* is therefore regarded with something like pride by the Clydeside artisan, and it is hoped that the trade legend "All our own make" may apply to a growing number of Clydeside productions.

The new transport, for which the Fairfield Co. received an order last month from the Indian Government, is to be named *Hardinge*. In length she is to be 407 ft., with a beam of 50 ft. 10 in., and a depth of 38 ft. In sea-going trim she will draw about 19 ft. of water, and displace 6,520 tons. The builders have guaranteed a speed, on a six-hours' deep-sea trial, of 18 knots, although the real object sought to be attained is to ensure there being ample power for 17 knots to be easily and continuously realised with ordinary coal and inexperienced native stokers. The total I.H.P. is to reach 8,000, the engines being of the triple-expansion type, to be run at 110 revolutions per minute.

The Clydebank Engineering and Shipbuilding Co.—the staff of which has not undergone any alteration of note since its being acquired by John Brown & Co., Limited, of Sheffield—is to-day credited with having received an order from the Admiralty for the engines and boilers and auxiliary machinery for one of the first-class cruisers being built in the Government dockyards. The engines will be of about 22,000 I.H.P.

Messrs. Robert Napier & Sons, who have still on the stocks for the Royal Mail Steam Packet Co. a cargo-carrying vessel of 2,860 tons gross register, and about 1,400 I.H.P. took out on her speed trials, about mid-month, the splendid mail and passenger steamer *Tagus*, the first of two similar vessels they have on hand, also for the Royal Mail Co. The second of the pair, the *Trent*, is now opposite the builders' yard undergoing her outfit. These vessels, which are 410 ft. long by 50 ft. beam, by 35 ft. moulded depth, and about 5,100 tons gross, have been specially designed and equipped to suit the requirements of the company's West India mail service. As speed is an important element, they have been constructed on fine lines, with heavy triple-expansion engines of 6,800 I.H.P., and they are of course fitted with all the latest improvements for the comfort of passengers. The most modern appliances have been introduced for the efficient working of the vessels and the rapid and noiseless handling of cargo, including Brown's hydraulic cranes, refrigerating machinery, and chambers for frozen meat, &c., and a very complete installation of electric lighting, the plant including three dynamos. Including the three vessels above referred to, the fleet of the Royal Mail Steam Packet Co. now consists, all told, of 32 steamers of a total gross register tonnage of 97,800 tons and 107,850 I.H.P.

Messrs. Alex. Stephen & Sons, of Linthouse, will launch some time this month the screw steamer *Sicillian*, of 10,000 tons, for the Allan Line. This vessel is a sister ship to the *Bavarian*, recently handed over to the Allan Line by Messrs. Denny & Brothers, Dumbarton, and since chartered by the Government as a troopship. Two other vessels on hand at Linthouse are those intended for the new Jamaica Shipping and Transport Co., formed to conduct a direct fruit and passenger service between Jamaica and the United Kingdom. Four vessels altogether are now taking shape for this service. Besides Messrs. Stephen & Sons' two, one is on hand in the yard of Messrs. Ramage & Ferguson, at Leith, and one in the Caledon Shipbuilding Yard, at Dundee. Under the contract with the Government, which is for a period of five years, the steamers will run fortnightly at an average speed of 15 knots between Kingston and Port Antonia and Southampton. They will be arranged specially for fruit carrying, and will have storage for at least 20,000 packages of bananas, besides accommodation for 25 first-class and 12 second-class passengers. The company have undertaken to have the service working by the 1st of May next.

Messrs. William Denny & Brothers, Dumbarton, who for many years past seem never to have been without one or more high-speed mail and passenger steamers on hand—paddle or twin-screw—are shortly to launch the *Anglia*, a swift twin-screw vessel for the London and North-Western Railway Co. and are laying down at present a new crack paddle steamer for the "Belle" Line, to be named the *Southwold Belle*. Early in the month they launched the twin-screw *Hibernia*, a sister ship to the *Anglia* above mentioned. Both vessels are virtually sister ships to the *Cambria*, built by the firm for the London and North Western Co. in 1897. The length is 340 ft., beam 39 ft., and depth to the awning deck 24 ft. They will no doubt be as speedy as the *Cambria*, which on trial attained a maximum speed of 22 knots on the measured mile, and 21·35 on the 100-knot course. The *Hibernia* is the fifth vessel built by Messrs. Denny for the company, they having in fact been entrusted with the contract of practically renewing the company's fleet of mail steamers—the *Rosstrevor*, *Connemara*, and *Galtee More* being employed on the Holyhead and Greenore service, whilst the *Cambria*, *Hibernia*, and *Anglia* are, or will be, employed upon the Holyhead and Dublin passage. All the vessels have been built under the supervision of Captain Binnie, the able marine superintendent to the company.

Messrs. William Hamilton & Co., Port-Glasgow, are reported to have received an order to build a large four-masted steel sailing ship for Liverpool owners. The only other orders on hand for sailing craft on the Clyde are one for a three-master in the yard of the Ailsa Shipbuilding Co., of Troon, for Glasgow owners, and one for a three-masted fore-and-aft schooner in the yard of Messrs. Robert Duncan & Co., Port-Glasgow, for Mr. John Ena, of Honolulu. In this connection it may be of interest here to add that of the ninety odd vessels at present building on the Tyne not one is to be propelled by sails.

A not inconsiderable quantity of shipping turned out from the Clyde shipyards is ushered—not in the form of complete ships into its "native element"—but through the yard gates in pieces, much in the same way as the pieces of unworked material had entered through the same gates some time before. For this reason the records of "ship launches" from day to day, and the returns of tonnage output given each month, are apt to be short by the amount of such work completed, although account is no doubt duly taken of it in making up the total output at the end of the year. All such shipping, mostly for light-draught service in inland lakes or rivers abroad, is of course transported in pieces to its destination, and there reconstructed and launched.

A notable cargo of this character was shipped at Glasgow during the month per s.s. *Hollinside* to Chinde at the mouth of the Zambesi. This consisted of as many as three different steamers—or rather their component parts—destined for service on inland African waters. Two of the vessels, named the *Empress* and the *Duchess* respectively, are intended for the African Lakes Corporation, Limited, on the Zambesi and Shirè rivers between Chinde and Katunga, to run in conjunction with their sister ship *Princess* and six other steamers owned by the corporation, plying on both rivers and lake. The *Empress* and *Duchess*, like most of the previous vessels, were built by Messrs. Ritchie, Graham & Milne, Whiteinch, and after having been engined by Messrs. Campbell & Calderwood, of Paisley, and tried for speed on the Clyde, were dismantled, taken to pieces, and their shipment begun. The third steamer shipped per *Hollinside* was to all intents and purposes a floating college for the missionaries of the Universities Mission, and will ply upon Lake Nyasa as a missionary ship and training college for the black inhabitants along the shores of that lake. This vessel has been built and engined by Messrs. Alley & Maclellan, Polmadie, Glasgow, and is 126 ft. long by 20 ft. in breadth, and 6 ft. 6 in. load draught. She is fitted with a locomotive boiler adapted for burning wood and supplying steam at 150 lbs. pressure to compound jet condensing engines of 220 I.H.P. The two steamers just referred to are of 105 ft. and 95 ft. length respectively. They were all, of course, shipped in pieces, and when their destination is reached they will be re-erected, by native labour mostly, and at once put into their respective spheres of service.

It is of decided interest, in connection with the foregoing, to mention that mail advices just to hand from Nyasaland note the fact that the *Queen Victoria*, plying on Lake Nyasa, had just made the record passage from the south end to Karongas at the north end of the lake, a distance of 330 miles in 33 hours, exclusive of 3 hours' stoppage on the way to take on board wood fuel. This is the fastest passage ever made on Lake Nyasa, and is in striking contrast to the time taken to accomplish the same voyage even two or three years ago, not to speak of the many weary days it took in Livingstone's time.

The Ailsa Shipbuilding Co., of Troon, have now got the new graving dock in good going trim, and both in the matter of overhaul and repair work, as well as in regard to the production of new vessels in their enlarged building berths, the firm are very actively employed. At the present time they are having their premises, and the yard generally, equipped with the electric light

The Irvine Shipbuilding and Engineering Co., Limited, have booked an order for a steamer of 850 tons for Messrs. J. & P. Hutchison, Glasgow, intended for their Continental trade.

From the shipyard at Ardrossan, which was acquired sometime ago by the Ardrossan Dry Dock and Shipbuilding Co., Limited, there was launched during the month a steel quarter-deck cargo steamer, the first launch since the yard was acquired. The vessel, which was named the *Humber*, is owned by Mr. Hutchison, of Hull, and is to be employed in the Continental trade.

The Campbeltown Shipbuilding Co., who have as a rule two, and sometimes three, steamers under way, "on spec.," have recently sold one of the vessels at present on their stocks to an Australian firm, who will employ her in trade between Australia and the adjacent islands.

The Grangemouth Dockyard Co.—who have been making rather a speciality of steamers for the carriage of oil in bulk for some time—launched, on the 20th ult., the *Kokine*, being the second of two oil steamers built to the order of Messrs. Jacobs & Barringer, London, and the fifth steamer of this class turned out within the last few years. The vessel, which is for Eastern clients of the firm above named, is 355 ft. long by 32½ ft. beam, and 24 ft. moulded depth, has been built to the highest class at Lloyd's, and is provided with all the most modern appliances for a vessel of this type. She is subdivided into 18 compartments, of which 14 are oiltight, for the carriage of oil cargo in bulk.

Messrs. Menzies & Co., Limited, Leith, who some time ago took over the shipyard at Inverkeithing, formerly carried on by Messrs. Cumming & Ellis, are completing the vessels that firm had on the stocks, and are in treaty for several other important orders. They have engaged Mr. Ellis to manage the practical work of the shipyard, under supervision from their headquarters at Leith. The engineering and ship-repairing branches of the firm at Leith are being very briskly carried on, and, although greatly taxed, are executing overhauls and repairs of all kinds with dispatch and thoroughness. The situation of the firm's premises in the very heart of the dock system enables a ready and close personal supervision to be made of all the work under way.

The shipbuilding industry in Dundee is scarcely in such a satisfactory state as it might be, few, if any, orders of any consequence having been received of late. There has, as my notes have shown, been a fair amount of work on hand since the beginning of the year, but contracts have been gradually worked off without there being in every case anything fresh to begin. The Caledon Shipbuilding Co. have arranged with the Works Committee of the Dundee Harbour Trust to extend their shipyard riverwards a piece, and the driving of piles and necessary filling in is to be done by the Trust, the company being charged a percentage on the cost in addition to the rent of the ground.

A deputation appointed by the Clyde Navigation Trustees to visit the more important docks in England and Wales where mineral traffic is extensively carried on left Glasgow on the 12th ult. on their mission. The main object in view was to personally inspect, and obtain information regarding, the most efficient methods and latest improvements which have been introduced in connection with the handling of mineral traffic in the ports to be visited; all with special reference to the laying out of the new dock the Trust has been empowered to construct at Clydebank. The deputation consisted of: Sir David Richmond, Lord Provost of Glasgow; Dr. John Ure, Messrs. Gray, Chisholm, Mason, Clark, Robertson, Raeburn, and Mr. T. R. Mackenzie, secretary to the Trust. The deputation first went to Hull, where they spent all Friday inspecting the docks there. On Saturday the deputation proceeded to Gloucester, where they spent Sunday, and thence they went to Cardiff, Swansea and Barry, and afterwards returned northwards to Liverpool, arriving back in Glasgow on Wednesday, the 18th ult. The deputation were especially impressed with the immense increase in dock accommodation at the South Wales ports—viz., Newport, Barry, Port Talbot, Cardiff, and Swansea—and with the modern and highly capable character of the lifting and transporting appliances for dealing with minerals. This particularly applies to Barry, which of all the ports is the largest and most modern in regard to equipments for the shipment of coal. Another feature with which the deputation were much struck, especially seeing that it has a close bearing on the situation as far as the present Glasgow docks are concerned, was the enormous expanses of vacant ground and railway by-accommodation surrounding the docks—notably those at Barry, Port Talbot, and Cardiff.

During the end of the month the opening meetings of most of the engineering and scientific societies of Glasgow were held, and the proceedings of the session fairly entered upon. The opening meeting of the forty-third session of the Institution of Engineers and Shipbuilders in Scotland was held on the 24th ult., and was addressed by Mr. Robert Caird, F.R.S.E., of the well-known Greenock shipbuilding firm, who is the president of the institution for the next three years. Mr. Caird dealt in his address mainly with technical education in the branches of industry the institution represented, and the means presently existing, and those desirable, for its successful carrying out. He put in strong pleas for the frequently advocated engineering laboratory and experimental tank in connection with Glasgow University. Mr. Caird's address was followed by a paper "On Lighthouse Engineering at Home and Abroad," by Mr. J. A. Purves, D.Sc., F.R.S.E., and the presentation of premiums of books to various readers of papers during last session. Amongst other papers to be read during the session now entered upon, having reference more or less to shipbuilding and marine engineering subjects, the following may be named: "Bilge Keels and the Rolling of Ships," by Mr. W. J. Luke, naval architect at the Clydebank Works; "The Design and Construction of Yachts, as affected by Racing Rules," by Mr. J. R. Barnett, chief draughtsman with Messrs. G. L. Watson & Co., Glasgow; "Superheating," by Professor Watkinson, of the Technical College, Glasgow; "A new form of Piston Valve," by Mr. William O'Brien, formerly of the Fairfield Co.

The 1899-1900 session of the Glasgow Technical College Scientific Society was opened on the evening of the 21st ult., when Mr. David Home Morton, the president, gave an interesting and most comprehensive historical outline of the progress of "British Industries" during the 18th and 19th centuries. Amongst other papers to be read during the session are: "On Steam Engine Indicators," by Alexander B. Dobbie, B.Sc.; "On Repairs to Hulls and Machinery on Modern Steamships," by Mr. John White Boyd, M.I.N.A.; and "The Introduction and Development of Machine Riveting in Shipbuilding," by Mr. David Pollock, M.I.N.A. and a member of the Institution of Engineers and Shipbuilders.

The opening meeting of the present session of the West of Scotland Iron and Steel Institute took place on the 20th ult., when Mr. Joseph Beard, managing director of the Gartcosh Ironworks, delivered his presidential address, which took the form of a "Review of Sixty Years in the Ironworks," and proved most interesting and informative.

The next James Watt anniversary lecture, which rightly holds an important position in each year's course of lectures delivered under the auspices of the Greenock Philosophical Society, is to be delivered on the 19th January (the anniversary of the inventor's birth) by Professor Oliver J. Lodge, D.Sc., LL.D., F.R.S., of University College, Liverpool, his subject being "Various methods of Space-Telegraphy."

THE TYNE.

(*From our own Correspondent.*)

Shipbuilding.—The diversion of a number of large steamers from their regular trading services to the carrying of troops and general campaigning accessories for the Government cannot but have a stimulating effect in the placing of orders for new tonnage, and the favourable influence is already shown by an appreciable increase of enquiries. But for the fact that prices are somewhat of the prohibitive order, a good deal of business would now be going on in the estimating or contracting departments of most shipbuilding firms; but on account of the reason named, together with the circumstance that they are already well booked forward, the opposite condition of affairs appears at the moment to most largely prevail. As far as regards prices, it is pretty safe to say that they are not likely to lose any of their firmness just yet; and in some well informed quarters the opinion is held that no downward movement need be looked for until, at least, the first half of the year 1900 has run its course. We anticipate that the closing weeks of the present year will witness something like a "rush" on the part of shipowners to place orders where they can, and it is much to be feared that they will not have the opportunity of doing so, except at enhanced rates. There have now been two or three years of exceptional briskness in shipbuilding, and according to former precedents, the retrograde movement should now be within sight; but several circumstances have combined to put off the inevitable reaction, and it is quite on the cards that the present brisk period will turn out to be the longest on record.

We are this month in a position to speak definitely of the future of the Palmer Co.'s Howdon Yard, for the property has passed out of the company's hands, and will now be divided between two firms whose premises are adjoining. Messrs. Cookson & Co., lead manufacturers, have one portion (about half), and have already commenced to erect buildings suitable for the purposes of their business; whilst the Tyne Iron Shipbuilding Co. are understood to be in negotiation for the other portion. It is somewhat unfortunate that a public road runs between the Tyne Shipbuilding Co.'s yard and the premises to which we have been referring; and it is possible that the existence of this roadway may prevent or postpone this much needed extension of a prosperous concern. Municipal authorities are, however, now generally very willing to further the efforts of local firms in the direction of development, knowing that this is the surest way to encourage local trade; and we have no doubt that in the case under notice a way will be found for the removal of the difficulty, even if it involve the diversion of the public road.

We notice that, in addition to the three large passenger and cargo steamers that are on the stocks at Messrs. Armstrong, Whitworth & Co.'s Low Walker Yard, some half-dozen small vessels have just been laid down, and there is also a vessel of medium size in the framing stage. At the company's Elswick Yard there is a large amount of work on hand, and arrangements for the laying down of others (as soon as berths become vacant) are in progress. The calling up of the Army Reserve for service in South Africa has, it is understood, to some extent interfered with the operations of this company in the shipbuilding as well as in other departments. The hindrance, however, is only temporary, as the places of the men withdrawn from employment are being rapidly filled up.

Messrs. Wigham Richardson & Co. have just laid the keel for a large twin-screw steamer, and have three others in course of plating or framing, besides a couple in the water fitting out. It is understood that some time ago this company offered facilities to their workmen to become shareholders, the "unit" of the shares being 20s. These facilities have not been taken advantage of to the extent desired, and, speaking of this on a recent occasion, the chairman of the company attributed the disinclination to make application for shares to a supposed feeling of antagonism on the part of the leaders of trade unions. Assuming this opinion to be correct, it is another blot upon the escutcheon of trade unionism; for nothing surely can be more detrimental to the working classes than to prevent them becoming part owners of the works and participators in the business in which they are engaged.

Messrs. C. S. Swan & Hunter are preparing the covered berth, from which the big Cunard liner was launched a few weeks ago, for the laying down of another vessel of an important class. There are some half-dozen vessels in various stages of progress on the stocks, and the briskness of all departments is very fully maintained. We notice that a pontoon floating dock is moored in proximity to the yard, and we understand that it has been brought there to be repaired and altered.

The Palmer's Co., having definitely resolved to concentrate their shipbuilding operations at their Jarrow Yard, are further improving the equipment of that establishment by displacing some of the older machines and substituting others of an improved type and greater power. They are, in fact, doing everything that is possible to modernise all the departments of the yard, with a view to the attainment of the highest productive efficiency. They have not, like most other firms, been under the necessity of greatly altering the arrangement of their building berths to suit modern requirements, as their berths were already large enough for the building of almost any size of vessel, the original projectors of the enterprise having been sufficiently wise to allocate abundant space for constructional purposes. They have had, of course, to pile the berths set apart for the building of warships, but this was done pretty effectually some years ago, and warships of the very largest dimensions can now be put down without risk. Of the merchant ships in hand at the present moment, two are well advanced, and three in early stages, whilst all are of very considerable carrying capacity. A rumour has been current to the effect that the company had it in contemplation to enlarge the graving dock, which is already one of the largest in the district, being no less than 440 ft. long. We are not in a position to contradict or confirm this report, though we think it not outside the pale of possibility that the company may be disposed to go in for an enlargement of the dock if there is room.

Messrs. Hawthorn, Leslie & Co. have a large meat ship almost ready for launching, whilst two others are in the plating and framing stages. They are laying the keel for a torpedo-boat destroyer, and have one in the water receiving her final equipment of machinery. There is a good-sized vessel undergoing repairs in the graving dock. Messrs. Robert Stephenson & Co. are proceeding actively with the finishing of the Spanish pontoon dock referred to in a former number, and they have just launched the last vessel on the stocks, this being a boat of medium size for the United Steam Shipping Co., Copenhagen. It is understood that the making of a new graving dock, to be over 600 ft. long, and to be equipped in a very elaborate manner, will be commenced shortly, and that other improvements of a comprehensive and most important character will also be entered on. The owners of the Northumberland Yard are said to have received an order for a tolerably large vessel from Newcastle owners, and they have at present on the stocks three vessels of about 4,000 tons each. They have also a large boat in the water fitting out. Other firms that have not been specially mentioned still maintain a good show of work.

Engineering.—There is scarcely any perceptible falling-off of briskness at the larger engine works, though one or two of the smaller establishments are, perhaps, not quite as busy as at the beginning of the year. In Messrs. Stephenson's locomotive departments there is a distinct lessening of activity, but this apparently is not caused by any lack of orders, and need not be looked upon as an indication of declining trade. The fact that a big programme of alterations is about to be entered on has doubtless prevented the initiation of new contracts in the constructive departments, and we look forward to seeing this company, in the course of a year or so, far outdoing in both locomotive and marine work all their previous undertakings.

Messrs. Emerson, Walker & Thompson Brothers, Limited, continue to have an abundance of work for their various departments, and in many of the shops night and day shift is maintained. There is an increasing demand for the company's special anchors, and their patent windlasses and other deck accessories are also in great request.

The chain and anchor departments of Messrs. John Abbot & Co. are exceedingly busy, and in the ironfoundry—which has recently been enlarged—orders are plentiful. At the foundry of Messrs. Chapman & Carverhill, Elswick, there are just now in hand some exceptionally important contracts in marine work, and during the remaining months of the year several castings of unusually large dimensions will be turned out. Amongst the very recent products of the establishment is a low-pressure cylinder weighing over 13 tons, ordered by a Sunderland engineering firm. Though the two establishments mentioned are undoubtedly very fully employed, business in the ironfounding trade does not seem to be uniformly good, and we hear of more than one foundry which was busy in the summer months, as being now in the opposite condition.

Mr. W. F. Snowdon, 36, Side, is experiencing a large demand for his patent removable asbestos mattresses, which are found to constitute a most convenient and effective covering for marine boilers. Amongst the contracts now in hand is the covering of the boilers of the New Zealand Steam Shipping Co.'s fine steamer *Karamea*, which has been built and engined by Messrs. Hawthorn, Leslie & Co.

In electrical engineering business continues to be very brisk, Messrs. Holmes & Co. having a large number of ship installations in hand.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—The large steamer *Waroel*, which was built for the colonial meat trade by the Sunderland Shipbuilding Co., has been chartered by the Government to convey horses and troops to South Africa, and her interior arrangements have been altered to fit her for the new service. A large force of men was engaged on the work, and at the date of writing it was expected that everything would be completed in time for the despatch of the vessel to Southampton. Besides the "urgency" contract, the Sunderland Shipbuilding Co. have a good deal of work in hand, as is also the case with the neighbouring firm, Messrs. Bartram & Sons.

Messrs. J. L. Thompson & Sons, who have lately extended their frame-making department, have just put down two Crossley gas-engines of 180 I.H.P. each, which are to be utilised for the driving of dynamos. The firm have ordered from the Sunderland Forge and Engineering Co., Limited, a dynamo of large power, and other plant for the further application of electrical power in the frame-making and other departments. The firm have, as usual, their five berths occupied, and in the preparatory departments activity still continues to be noticeable.

Through the courtesy of Messrs. Doxford & Sons, we are enabled to give a full list of the firms—British and foreign—who have up to the present time adopted the principle of "joggle" plating, and provided themselves with the necessary "roller presses" for carrying out the process. The British firms are:—The Fairfield Shipbuilding and Engineering Co., Limited, Glasgow; W. Denny Bros., Dumbarton; Hawthorn, Leslie & Co., Limited, Newcastle; Sir James Laing & Sons, Limited, Sunderland; Earle's Shipbuilding and Engineering Co., Limited, Hull; R. Craggs & Sons, Middlesbrough; H. S. Edwards & Sons, South Shields; W. Doxford & Sons, Limited, Sunderland (three machines); Sir W. G. Armstrong, Whitworth & Co., Limited, Newcastle; Yarrow & Co., Limited, London; A. Stephens & Sons, Glasgow; J. L. Thompson & Sons, Limited, Sunderland; W. Pickersgill & Sons, Sunderland. The foreign firms who have adopted the system and bought machines are:—The Flensburg Shipbuilding Co., Flensburg; Société Anonyme des Forges et Chantiers de la Méditerranée La Seyne (two machines); Koninkligke Maatschappij De Schelde, Kissingen; Chantiers et Ateliers de Penhoet, St. Nazaire; Howaldtswerke, Kiel; Baltic Shipbuilding Co., Limited, St. Petersburg; Schiff-und Maschinenbau Actiengesellschaft "Germania," Kiel; Chantiers et Ateliers de Provence, Marseilles. It will thus be seen that 21 firms have adopted the system, eight of which are outside the United Kingdom. Of the 13 British firms that have availed themselves of the advantages afforded by this system, it will be observed that nearly all of them belong to the very first rank, as witness the Fairfield Co.; Armstrong, Whitworth & Co.; Sir James Laing; J. L. Thompson & Sons; Yarrow & Co., &c. The adoption of the system by such firms as these is a high tribute to its value, and a further testimony in the same direction is to be found in the circumstance that the great ice-breaker *Ermack*, whose power of crushing through the ice fields and releasing imprisoned vessels has excited so much wonder, is plated on this principle. Structural strength was one of the first essentials for a vessel of this kind, and it was evidently believed that "joggle" plating would contribute to the attainment of the greatest possible strength, with the designs and materials to be dealt with.

Messrs. Short Brothers have just launched a vessel 372 ft. long, ordered by a London company, and will shortly place the keel for another large vessel in the vacated berth. There are three vessels in various stages on the stocks, and at the repairing yard there are two or three vessels being repaired or fitted out. In the other yards a high rate of briskness is still to be noted, and in some instances repair work helps materially in the employment of labour.

Engineering.—We understand that at the Palmer's Hill Works (Messrs. Dickinson & Sons) there is now in an early stage of construction a set of engines larger than has hitherto been built at the works, or perhaps in the district. The boilers will, of course, also be exceptionally large, and improved hoisting, or lifting, apparatus is being put down. There are symptoms of incipient slackness at one or two of the other marine works; but the improvement that has recently been noticeable in the shipping trade may possibly tend to counteract any tendency towards retrogression.

Messrs. John H. Vaux & Co. will soon be in a position to commence productive operations at their newly erected marine engine works, near Sunderland Bridge. The machinery equipment is nearly complete, and we understand the firm has secured some orders to commence with.

At the Sunderland Forge and Engineering Co.'s Works business continues exceedingly brisk in both the electrical and the forging departments. Several heavy stern frames for ships being locally built are in progress, and the orders for single-plate-built rudders are very numerous. The forges at Pallion, and also the Anchor Works, are kept in steady operation. The Monkwearmouth Ironworks and also the Monk Street Foundry continue to be well employed.

The Hartlepools.—Shipbuilding is still brisk at this centre, there being a considerable amount of repair work in hand to supplement the new work. The engineering establishments are also showing well sustained activity, and Messrs. Richardson are experiencing a good demand for their new speciality, "lockfast iron." This material is specially recommended for propeller shafts, and it is understood to possess qualities which render it eminently suitable for the purpose. The Hartlepool Steelworks are kept very briskly going, and other local industries are fairly prosperous. At the docks, however, a slight diminution of activity is noticeable, the close of the timber importing season being near at hand.

Stockton.—Messrs. Craig, Taylor & Co. are now pretty well through with their extensions, a detailed account of which we hope to be able to place at an early date before our readers. The firm have just launched a handsomely designed vessel, ordered by Hamburg owners, and have three other vessels in different stages of construction on the stocks. Engineering establishments are very busy, and in the local boiler works there is quite a plethora of orders. Steel and iron works are going full time, and the one firm that is engaged in the manufacture of steering gears and other steamship auxiliary machinery is as busy as could be wished.

Middlesbro'.—Shipbuilding firms are still well off for orders, and at the principal yard all the berths—except one vacated on the 21st ult.—are occupied. Engineering works continue busy, Messrs. Furness, Westgarth & Co. having some exceptionally important contracts in hand. Boiler and bridge works are also actively kept going, and in the ironfoundries full activity is maintained.

Darlington.—It is understood that Messrs. Robert Stephenson & Co., of Newcastle, are negotiating with a Darlington firm for the purchase of a site on which to build new engine works at that centre. Should the negotiations be successful, it is probable that the works, when erected, will be devoted to the manufacture of oil and locomotive engines exclusively.

THE MERSEY.

(From our own Correspondent.)

WHATEVER indications there were some time back of a possible slackening down of activity in the engineering trades of this district, and which tended to encourage a good deal of very low selling on the part of speculative merchants in the open market for forward delivery, would now seem to have disappeared Notwithstanding the considerable advances in the Bank Rate and the war complications in South Africa, which, had there been any real foundation for such an unfavourable outlook, would undoubtedly have produced a very perceptible depressing effect, the tendency of the market, and also as regards new trade coming forward, has, during the latter portion of the past month, been decidedly in the direction of increasing activity and a steady hardening in prices. In one or two branches of the engineering trade where there were undoubted indications that new work was not coming forward in sufficient quantity to replace that running out, it is reported that orders have been given out much more freely, and generally throughout all sections of the trade the prospects are that the exceptional briskness that has prevailed during the past twelve months is more than likely to be fully maintained for a considerable time forward, and, in all probability, right through the ensuing year.

Machine-tool makers continue exceedingly busy, with new orders generally coming forward satisfactorily. In the locomotive building trade important orders are being placed, both by home and colonial railways; boiler makers in this district have booked a number of large contracts during the past month; stationary engine builders are securing an increased weight of new work, whilst electrical and hydraulic engineers continue exceedingly pressed with orders

The employment returns issued during the past month by the leading trade unions bear continued evidence of the active condition of the engineering industries. The Amalgamated Society of Engineers reports a further reduction in the number of out-of-work members on the books, who now represent about two and two-fifths per cent. of the total membership. In the Manchester district the proportion is about 2½ per cent., and there is a continued call for pattern-makers and tool fitters. The local officials also report that things are running smoothly all round, and are likely to do so for sometime. In the Steam Engine Makers' Society there are about one per cent. of the total roll on donation, whilst locally, practically a clear book is reported. In this society, it may be added, most of the unemployed members are connected with branches in the marine centres of the North-East Coast. The Machine Workers' Association has now only 1⅘ per cent. of its membership receiving benefit; and in the Manchester district the position is even more satisfactory, only one-third per cent. of the local membership being on out-of-work donation. Reports as to the state of trade continue generally of a favourable character. With regard to wages matters, it may be mentioned that the termination of the wages dispute in the Mid-Lancashire engineering trade has been followed by a settlement of the dispute with the smiths and strikers, on the basis of an immediate advance of 6d., and a further similar advance to be granted later on.

Messrs. Crossby Brothers, of Openshaw, Manchester, have just delivered to an English firm the largest double cylinder gas engine they have yet supplied, viz., one of 550 I.H.P. It is combined by means of coupling on the crank shaft with a dynamo, and will be worked by producer gas. In oil engines the firm have also several new designs. One of these is a portable 10 N.H.P. engine, capable of giving 16 I.H.P. It can be started in about five minutes, and left running for many hours at a time, and can be easily attended to by any ordinary labourer, after a little explanation. The oil consumption is about half pint per actual H.P. per hour. Another pattern is a new nominal eight-man-power engine running at 300 revolutions, giving 1½ B.H.P., or if arranged for electric lighting, and fitted with two heavy fly-wheels it runs at 350 revolutions, and gives two B.H.P. This engine only takes about half a pint of oil per H.P. per hour, and can be easily set going in a few minutes' time.

Several improved designs in ventilating apparatus are being introduced by Messrs. Matthews and Yates, Limited, of Swinton, near Manchester. Amongst these is the "Cyclone" electric fan, which is a modification of their patent "Cyclone" air-propeller, combined with an electric motor giving off a very high efficiency. This fan, which is very easily fixed, is fitted with self-oiling bearings, and has an efficient arrangement of armature and commutator which will run for many weeks without requiring the slightest attention. One special advantage of the design is that the parts additional to the fan, and which revolve, are close upon the axis, and not, as in the case of some fans, upon the periphery, so that the least obstacle is offered to the passage of the air. The "Cyclone" air propeller is also adapted to a double-acting steam engine. In this form it is very simple in construction and can be easily fixed, the engine being so combined with the fan that it dispenses with foundations. This design is applicable to places where shafting is inconvenient, but steam available, no belts or other method of transmitting power being required. The engine is constructed to work at a pressure up to 100 lbs. per square inch, but the valve on each engine is set before leaving the works at the most economical position according to the pressure of steam used and the number of revolutions at which the propeller must run.

The same firm also make a special water-heating apparatus, which they have termed the "Simplex," and which will be found very useful for providing clean boiling water for work-people's meals. The apparatus is divided into two separate compartments, one of which forms a reserve for the cold water supply, and is fitted with a ball-tap, while the other contains a steam heating coil, the condensation from which is drained to a steam trap. The water is heated to boiling point in a few seconds after steam has been turned on, and the supply can then be maintained continuously. A further advantage is that there is no risk to the person using the heater through an accumulation of steam issuing from the draw-off tap when the latter is turned on, as is often the case with other heaters. The outer case is made of strong sheet copper, carefully tinned on the outside.

The Rossendale Belting Co., West Moseley Street, Manchester, have brought out a new boiler covering (Lawson's patent), which has given very successful results in actual use, and is specially applicable for marine purposes. The covering is of a fibro-plastic material, and possesses adhesive properties that render binding, supports, or lagging of any kind altogether unnecessary. The composition is supplied in the form of a dry powder, which the addition of a little water brings into a workable condition, and it is free from any ingredient that would be liable to cause injury to the boiler surface. A ton of this composition would, it is estimated, cover with a 2-in. coating 400 square ft. of surface, and what has been once used can be removed and again applied after mixing with water. When required for emergency cases it can be supplied in a plastic form, and when once applied, it can only be chipped off by means of a hammer and chisel. It is porous, so that the slightest leak can be detected, whilst it presents a surface that can be enamelled, but it is generally covered with a couple of coats of tar, which renders it completely water proof and specially applicable to boilers and pipes in an exposed condition.

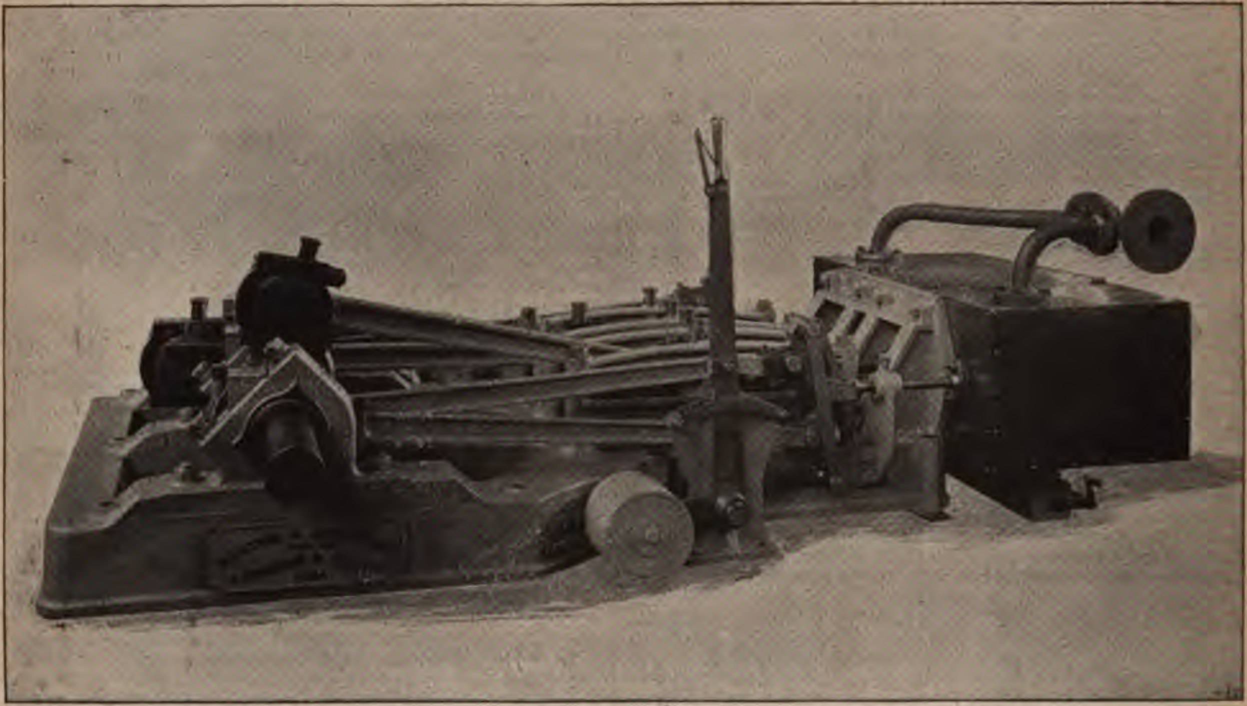
In the iron market here, the stronger tone referred to in last report has been more than maintained, and prices have shown a further hardening. For pig-iron a more active demand is coming forward, and although for the most part business is still confined to immediate wants, it represents on the whole a fair weight of buying, and certainly quite as much as makers and merchants—who are generally well sold—can entertain. Local makers have made no change in their quoted rate for foundry, which remains at 77s. 6d., less 2½ delivered Manchester, but, except for renewals of contracts with regular customers, they are practically out of the market. District brands have hardened up 6d. to 1s. per ton, Lincolnshire being quoted about 73s. to 73s. 6d. net, with Derbyshire makers asking about 77s. 6d. net, delivered Manchester. Forge qualities are also stronger, Lancashire averaging 73s. to 73s. 6d., less 2½, and Lincolnshire 71s. 8d. to 72s. 2d. net, delivered Warrington. Middlesbrough iron is about 1s. 6d. dearer, makers quoting 78s. 4d. net for good foundry brands, delivered by rail Manchester. Scotch shows a stiffening tendency, and is about 1s. dearer; Eglington and Glangarnock remaining at 79s. to 79s. 6d. net prompt cash; Manchester Docks, with American pig-iron about 77s. 6d. net.

In the finished iron trade, prices have been further advanced all round. Bars have been officially raised 5s. per ton, and Lancashire makers are now asking 2s. 6d. to 5s. above the official basis. Sheets are 5s. dearer, and hoops have been officially advanced 10s. per ton. Delivered Manchester district prices are now £8 17s. 6d. to £9 for Lancashire, and £9 for North Staffordshire bars; £10 2s. 6d. to £10 5s. for sheets

£9 7s. 6d. for random to £9 12s. 6d. for special cut lengths of hoops delivered Manchester district and 2s. 6d. less for shipment. Makers are well booked, in some cases up to March next, and business still comes forward steadily, although only in small quantities.

In the steel trade hematites are unchanged at about 87s. 6d. to 89s. 6d. less 2½ for No. 3 foundry, delivered here, but other descriptions of material have shown an upward tendency, and the prices quoted in some instances mean that makers have really nothing to offer. Local billets are not quoted under £6 12s. 6d. to £6 15s. net, with makers not offering. For bars the minimum quotation is now £8 15s. to £9, with boiler plates £9 10s. to £9 12s. 6d. delivered Manchester district.

An active demand is reported for manufactured metal goods, but list rates remain unaltered. Delivered Manchester district they are as under:—Solid drawn brass boiler tubes, 9d.; condenser tubes, 10½d.; copper tubes, 11½d.; brazed copper gas and steam tube, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d; common brass wire, 8½d.; and copper wire, 8¼d. per lb.



Cable Machinery for H.M.S. Cable Ship "Monarch." Fig. 1.

Business in the timber trade has been fairly satisfactory, and values are generally steady with an upward tendency for some of the leading articles. Imports have not been excessive, and deliveries have been fair; stocks with few exceptions are only moderate. Teak squares have been imported in fair quantities, and the demand is quiet, but prices are firm and the stock is not heavy. Planks have come in freely and prices are rather easier, with stocks adequate. One cargo of greenheart has arrived, and the stock is too heavy.

In the coal trade, although there has been some easing down from the exceptional pressure of demand which preceded the advance in prices, an active business has been reported generally during the past month, and collieries, working full time, have not only moved away all their production, but have had to fill up out of stocks to meet the requirements of customers. Under these conditions, and in view of the movement amongst the miners for a further advance in wages, the question of prices is again being considered, and a further upward move, will not be long delayed. House coals have been in brisk request at the full rates. Steam and forge qualities continue in pressing demand, with supplies short to meet the requirements of customers. In engine fuel, notwithstanding the increased production of slack, supplies are still generally below requirements, and prices are strong at the recent advance on current sales, whilst in forward contracts 3s. to 3s. 6d. over last year's rates is being got. The shipping trade is fairly brisk, both for steam coal and house-fire descriptions; the quantities offering in this department are considerably restricted owing to the activity in the inland trade, and prices have shown a further hardening upon recent quotations. Current prices are about 12s. 6d. to 13s. 6d. for best Wigan Arley; 11s. to 11s. 6d. for Pemberton four-ft. and seconds Arley; 10s. 6d. for common house coal; 10s. steam and forge coal; 7s. 6d. best engine fuel; 6s. 6d. good medium sorts, and 5s. 9d. to 6s. 3d. common slack. Delivered Mersey ports or Ship Canal steam coal averages 10s. 6d. to 11s., and better sorts, suitable for house-fire purposes, from 11s. 6d. upwards.

Coke is in pressing demand, and good furnace qualities have stiffened up to about 20s. to 22s., but foundry cokes are without quotable change, best descriptions remaining at about 26s. to 27s. at the ovens.

THAMES.

(From our own Correspondent.)

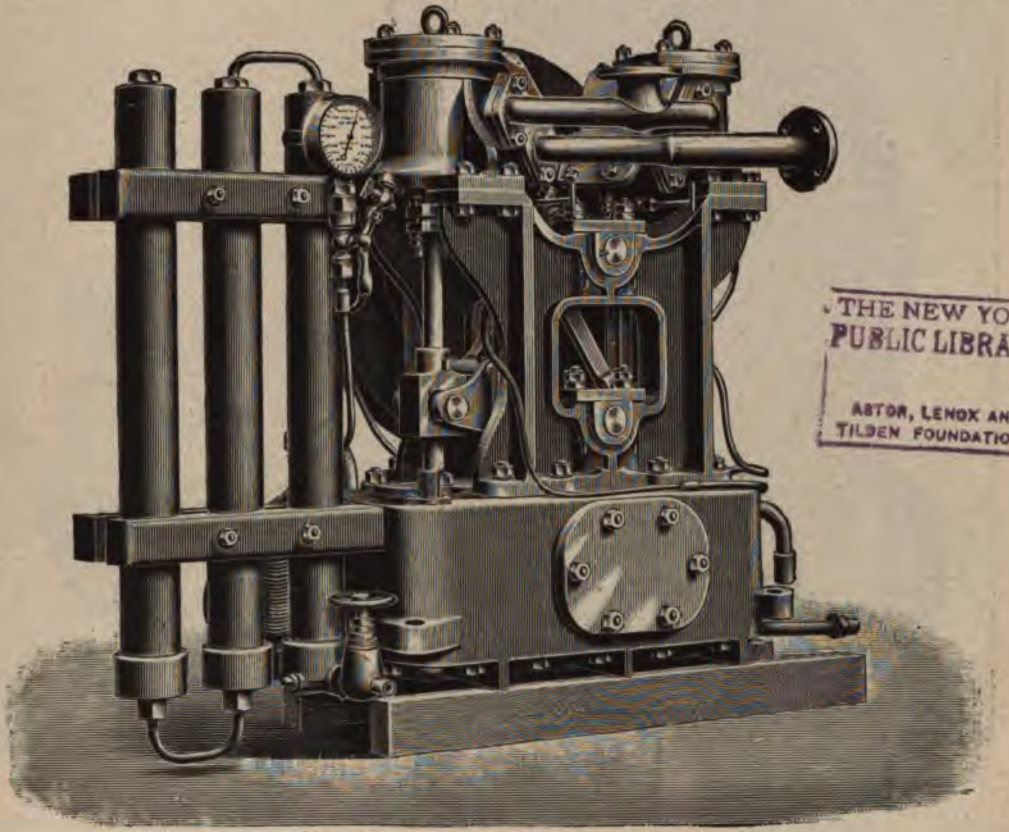
Easton, Anderson & Goolden, Limited.—This firm is still busy with its orders of Admiralty auxiliary machinery. The engines for H.M.'s. cable ship *Monarch*, are placed forward in the ship for driving the heavy machinery required for the picking up gear. The cylinders of these engines are 12½ in. diameter and 20 in. stroke, and are arranged to run at 120 revolutions per minute, with a steam pressure of 80 lbs. per square inch. The engines are made reversing and of a very massive and strong construction, to withstand the abnormally heavy strain occasionally coming on them when dealing with heavy submarine cables. They are placed on deck and had to be made of a sepcial design to bring them into the very small space at disposal; they had also to be kept as low as possible to clear the cables passing over them. We illustrate these in Figs. 1 and 2.

The air compressing engine and receiver formed part of a very extensive air-compressing plant supplied for the torpedo service of the Imperial Russian Government. The compressing engines are of the two stage type and the receiver is made of a series of tubes and the whole plant is made as compact as possible as space was of very great importance.

We also illustrate Fig. 3 an electric fan which is one made by this firm for ventilating purposes. It is driven by a motor of one standard 5 brake H.P. running at 800 revolutions per minute.

The latest order is one from the Admiralty for a set of large air-compressing beam engines for Portsmouth Dockyard.

In our last issue we referred to the pumping engines which this Company constructed for the Leicester Corporation Works. We had only space to give the general dimensions and could not give the results of the trials. The circulating pump drew and delivered into a cooling pond 400 yards away from the engine-house, the head in the pump being 8 ft. exclusive of friction in the pipes. This circulating pump was 6 in. diameter and 3 ft. stroke double-acting. There is a circulating condenser fitted to each engine having a cooling area of 298 square feet, the circulating pump water passing through the tubes. The ordinary working speed is 25 runs per minute, but the engines are designed to work up to a maximum speed of 30 revolutions.



Air Compressing Engine. Fig. 2.

THE NEW YORK PUBLIC LIBRARY
ASTOR, LENOX AND TILDEN FOUNDATIONS.

The trials were three in number:—

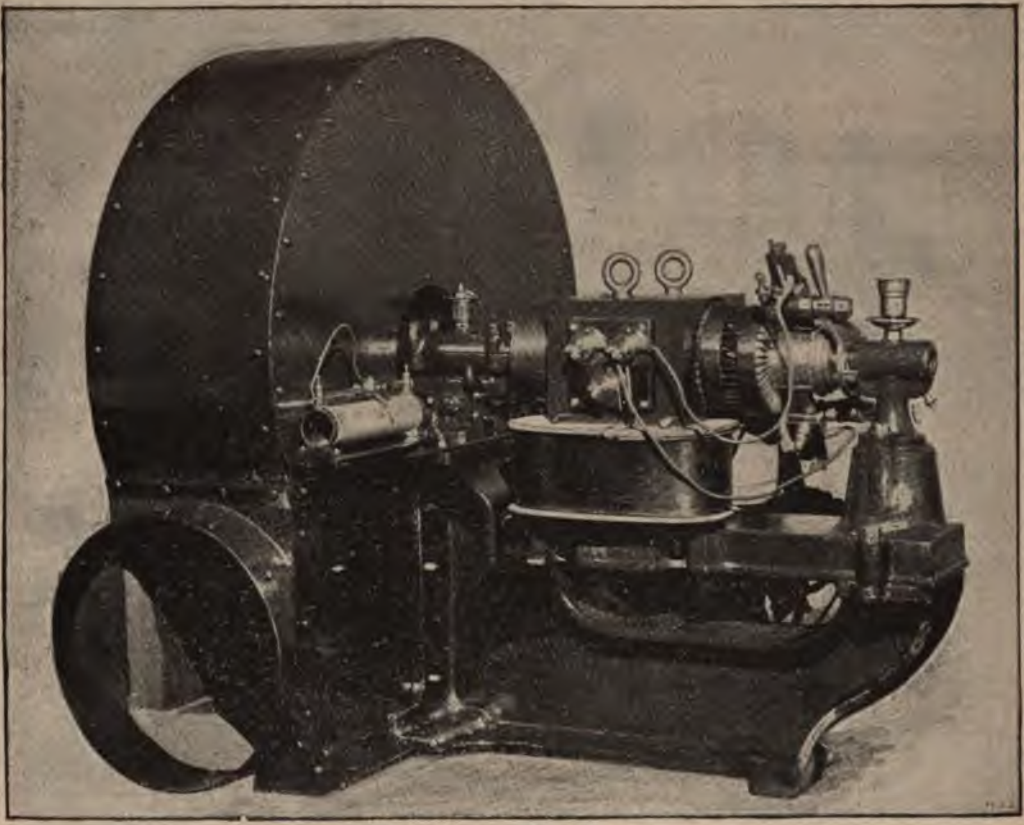
February 8th.	No. 1, Engine singly.
" 9th.	No. 2, " "
" 11th.	Nos. 1 & 2 combined.

The trials of the boilers were taken separately, but during the engine trials the evaporation of the boilers and the coal consumed were measured in order that results might be obtained of the evaporation and fuel under ordinary working conditions. The trials lasted in each case 12 hours, beginning at 9 a.m., and lasting until 9 p.m. The engines were started a short time previously to commencement of the trial, in order that everything should be under normal working conditions when the trial began. The steam used by the engines was ascertained by weighing the air-pump overflow and the water condensed in the cylinder jackets, and adding the two together the water from the cylinder and valve chest drain cocks was also included in the air-pump overflow. The head of water on the pumps was taken from the engine-room pressure gauge, which was afterwards tested against a mercury column, and the results corrected. The water pumped into the reservoir was measured by observing the height of water in reservoir every half hour; in addition, two small branches on rising main had Siemens water meters upon them, and the quantity registered by them was added to the total. During the trial, readings and diagrams were taken every half-hour; they were taken separately, both by the staff of the Corporation and by that of the contractor. The results of the trials of these engines will be given in our next issue.

Tolch & Co.—We illustrate, Fig. 4, another of this firm's oil launches.

John I. Thornycroft & Co.—The great international yacht race has at last come and gone. For several days, and with weather and wind favourable to the *Columbia*, the *Shamrock* showed that she could more than hold her own with her opponent. But one day came when there was sufficient wind, and the *Columbia* happened to come in first. After that the skipper of the *Shamrock* appeared to lose his head, for he crowded more sail on his topmast than it could carry, with the result that the topmast broke, and the rigging came down, with the consequence that the *Shamrock* left the course. Next day he did the next worse thing—added a heap of lead to the keel. He was, of course, beaten in sailing by a good distance. Sir Thomas Lipton has said he may challenge again in 1901, and that he will lend the *Shamrock* to the challenger of 1900 to try against it. Sir Thomas has said that Mr. Fife will again be the designer, and this probably means that the same firm will be the builders.

J. & E. Hall, Limited, Dartford.—This firm is exceptionally full of orders. The principle of action of these machines is the vaporisation of a volatile liquid at a temperature below that of the material to be cooled. The resulting vapour is then recompressed. There is first the compression-pump, which compresses the carbonic acid vapour by a pressure which is sufficient to liquefy the gas when it is cooled down by the water available. The gas so compressed is forced into a coil in the condenser through which water is made to run. When it has been cooled in this, and condensed, it is allowed to expand into the evaporator at a much lower pressure, where it becomes a gas again. The latent heat for this gas it extracts from the surrounding substance brine or water. The long coils fitted up in the cooling chambers through which the gas travels extracts the heat from the rooms, and leaves them cool. The gas then expands into the pump, gets again compressed to the high pressure of the condenser, and thus completes its cycle. The pressure put upon the gas by the compressor is, in some cases, over 900 lbs. per square inch. In some of the large machines it is 65 atmospheres. Where it expands into the evaporator the pressure is reduced to about 39 atmospheres. In such places as breweries the water surrounding the coils in the evaporator is drawn away at the temperature necessary for brewing purposes.



Electric Fan. Fig. 3.

BELFAST.

(From our own Correspondent.)

SHIPBUILDING and marine engineering news for the past month seems to be remarkably scarce, as work in both the large shipbuilding yards here seems to move along very slowly, and we are afraid the tonnage for the year will fall far short of expectation.

Many explanations are given for this condition of work, and no doubt the ironworkers are to blame for much of it, as it is said that as high as 75 per cent. has been lost by squads of these men for months past; other reports have it that there are fewer inquiries to hand and that builders are tapering off their work, and taking things more quietly, until prices of material moderate—no doubt this also has to do with the matter to a certain extent.

Messrs. Harland & Wolff, now have their second hydraulic gantry over one of their launching slips almost completed, and with these huge hydraulic tools in working order this firm should be enabled to fully cope with the riveting of their large class of vessels; and, as they have now in use electric and air drill and other appliances, this will also make them more independent of hand labour.

This firm have still the P. & O. steamer *China* in the Alexandria Graving Dock, and it will be some time yet before she is completed. The occupation of this large dock for such a length of time is causing great inconvenience, as many large vessels have to be accommodated elsewhere: this shows the urgent need of increased dry dock accommodation here to meet emergencies such as these.

The s.s. *Turkoman* (lately known as the *Lord Erne*) which has been in the hands of Messrs. Harland & Wolff for about two months back, receiving extensive alterations and being fitted up for the Atlantic cattle trade, left here last week to take up her station.

The s.s. *Persic*, as reported last month having been launched from the yard of Messrs. Harland & Wolff, is fast approaching completion in the Abercorn Basin and will soon follow her sister ships in the Australian trade, for which they have been specially constructed.

We understand that Messrs. Harland & Wolff, have recently booked two or three large orders for the Dominion and other lines.

The s.s. *Sicilian*, recently built and launched by Messrs. Workman, Clark & Co., Limited, for the Allan Line of Glasgow, would have left this port ere now but for the fact that she has been chartered by the British Government as a transport for the Cape. She is at present being fitted out for this particular service and in all probability will leave next week.

The smaller engine works, and especially the foundries, here are very quiet just now, which is probably due to the almost total collapse of the building trade; however, quite a number of new industries have recently sprung up in Belfast, such as the Ravenhill Ironworks, where structural ironwork, such as iron roofs, doors, &c., can be got.

We also have two new galvanising works in the city, and we hear that premises have been taken for the construction of tanks, ventilators, &c. Hitherto all goods of this class had to be imported from other towns, and great delay was sometimes felt in getting galvanising work done, as it had to be sent across channel after being fitted here, causing much loss of time.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—The shipbuilding trade of this district is still very well employed, and there are indications that for a long time to come this industry will be a most active one in all its departments. No new orders have been booked by builders during the month, but they have no need of them at present, and when they have, there will be plenty available. Builders have their hands full at present on Admiralty account, and most of their orders require prompt deliveries. Every day, however, is improving the position of builders in this respect, and gradually a larger number of men are being employed, and the number would increase in a larger ratio if there were plenty of houses for the men to live in. This difficulty, however, is gradually being disposed of, and alongside of this disposal additional workmen are finding homes in Barrow, and the work in progress at the shipyards is being correspondingly accelerated. Great progress is being made with the first-class cruiser *Hogue*, which is well in frame, whilst the *Euryalus* and the *King Alfred* are gradually lifting their sides. Considerable advance has been made with the Japanese battleship, and a good idea can now be formed of her enormous size. She will probably be launched after the *Hogue*, as the Japanese are anxious to get her as soon as possible, and in the meantime Messrs. Vickers, Sons & Maxim will probably secure other orders for warship construction from other Powers, and possibly further business from the Japanese themselves. The torpedo-boat destroyer *Otter* has now been formally handed over to the Admiralty after very successful speed trials. The Barrow Co. has now had very useful experience in the building of torpedo-boat destroyers, and there is reason to believe in all other work of this class they will be able to secure the realisation of the most exacting conditions with satisfactory results alike to themselves and the owners of these smart and useful craft. The Barrow Co. is now building another 30-knotter for the Admiralty, the *Vixen*, and probably other work of this class will follow. There is almost an absence of labour troubles in the Barrow yard, and when they do arise they are easily arranged.

Oil Launch, Messrs. Tolch & Co. Fig. 4.

The speech delivered by Mr. McLaren, M.P., on the occasion of the annual meeting of the Palmer's Shipbuilding Co., in which he referred to the great loss of time on the part of several workmen engaged in the shipbuilding industry, by which work was very seriously delayed, applies with equal force to all shipbuilding yards; and certainly the experience of Barrow in this respect is not only very annoying to shipbuilders, but to shipowners, who are anxious to get delivery of new ships whilst trade is good, freights high, and profits large. It is difficult to understand why workmen, and mostly those in the black squad, should be content to earn £5 or £6 a week when they could easily earn 40s. a week more. The difficulty builders have to face is all the more aggravating because there is a great scarcity of men in the iron department of all shipbuilding yards at present, and when those who are employed do not put in more than two-thirds of their time the result is very disappointing, as work in other branches of the trade where more regular working hours are observed is delayed in consequence of laziness in others.

The Pacific Steamship Co.'s new steamer *Ortona*, which has been built at Barrow for the Orient Line, to trade between England and Australia, will be ready for delivery during the month of October. The ship has won general admiration from all who have seen her, and she will certainly be far the finest ship under the Pacific Co.'s flag. Her equipment is splendid in every department, and in her cabin accommodation she is vastly superior to any liner ever built at Barrow. She will, in fact, compare very favourably with a first-rank Atlantic liner, except in the matter of speed, and speed at a high rate on Australian voyages has never been considered an essential, on account of the difficulty of the coal supply. There has, however, in recent years, been a great improvement in the speed of Australian liners, in consequence of the modern triple-expansion engine, which gives such economic results in coal consumption on a given power. Thus on the same coal consumption per voyage it is possible to attain a much higher rate of speed. In the case of the *Ortona* advantage has been taken of this fact to give her a speed of 15 knots, but her builders anticipate being able to get out of her at least two more knots, so that in her voyages to the Australian ports the *Ortona* may be expected to break the record in the case of any of the ships of the same fleet, most of which were built at Barrow like herself. It will also be found that the *Ortona* is the largest and certainly the most luxuriant ship in the service, and in respect of her fittings and general finish she will certainly prove to be a very good advertment for Barrow. In the future Barrow builders will certainly devote themselves more to the work of building high-class merchant ships than has been the fact in the past.

West Cumberland.—A very steady and regular trade is being done by shipbuilders in the West Cumberland district, and, although the district is not engaged in the construction of heavy tonnage, it is busy in the building of light tonnage craft, for which there is a good demand. Makers have a good number of orders on hand, and are in a position to get more if they were able to undertake additional work to that which they have already. They are not in a position, however, to accept any of the orders for heavy tonnage ships that are now in the market; but, whilst larger builders are concentrating their energies on heavier shipping, the small builders of West Cumberland are contenting themselves with the building of small ships, on which, generally speaking, there is a good margin of profit. The shipbuilding yards at Workington and Maryport do not employ many hands, but their trade seems to be regular, irrespective of the ups and downs of the market generally, with the consequence that in good times and in bad they have plenty to do. Their position at present is satisfactory alike in the work they have in hand and the price they are getting for it. They have in some cases been hampered through the inadequate delivery of material, but, generally speaking, they have been kept very busy. They have not cared to overburden themselves with orders, but have maintained a steady tonnage output, just sufficient to keep them briskly employed and no more. They have good prospects of new orders when they are ready for them.

Barrow Docks.—Commencing with November, the Ramsden Dock at Barrow will be closed to shipping, that is temporarily, pending the work of deepening the lock sill. As we have pointed out in previous numbers of the MARINE ENGINEER, the sill of the Ramsden Dock is 6 ft. higher than the bottom of the Ramsden Dock entrance basin, and vessels of great draught are compelled at present to discharge part of their cargo in the entrance basin before being able to proceed into the series of docks for full discharge. But this is not the only reason of the necessity for lowering the dock sill. The construction at Barrow of the largest type of warships with the greatest draught of water necessitates the deepest possible dock accommodation. This will now be provided, and in the meantime this entrance to the docks will be closed whilst Messrs. John Aird & Co., the contractors, do the work. Heavy draught ships will in the meantime discharge and take in cargo at the Ramsden Dock basin, where four deep-water berths have been provided, and lighter-draught vessels will proceed to the Devonshire Dock, which will accommodate ships drawing up to 24 ft. of water. The deepening of the dock sill will probably take six or eight months to complete. In the meantime the work of completing the battleship *Vengeance* for Her Majesty's Government will be proceeded with, but she will not be able to leave Barrow until the dock sill is lowered, nor will Messrs. Vickers, Sons & Maxim be able to launch the Japanese battleship or the three first-class cruisers they are building for the Admiralty until this necessary engineering work is accomplished. It will thus be understood that the work will be pushed on with all possible speed, and with that object a very large number of men will be employed on night and day shifts. When the work is done, however, Barrow shipbuilders will be able to undertake the largest and heaviest classss of shipbuilding work, and will also be able to undertake heavy repair jobs; but even then a new deep graving dock will be required, and this in the course of time will be constructed, the Furness Railway Co. having already obtained powers for this purpose.

Shipbuilding Material.—The shipbuilding material trade is very brisk, and makers are extremely busy, the orders in hand representing deliveries a long way ahead. The mills are kept constantly employed night and day, and it is difficult to place orders for early delivery, as the engagements of makers are already so full. The value of heavy steel plates of ordinary specification remains very firm at £7 12s. 6d. per ton, and boiler plates are at £9 per ton. Angles are quoted at 5s. advance on the month, and it is expected there will be a general advance in prices all round. There is a good enquiry for all classes of shipbuilding material, and heavy castings for ship and engineering work are in full demand, makers being exceptionally busy on large orders already on hand. It is probable that new works will spring into existence before long, in which the production of heavy forgings will be the feature. During the past few weeks new works have been started at Barrow for the manufacture of bolts and nuts on some new patent. Other new industries of some importance are likely soon to be started in Barrow.

The Hematite Trade.—Very much firmness is shown in the hematite trade, and orders are coming to hand with considerable freedom. Buyers indeed are asking for fuller deliveries than makers can give, and this notwithstanding the fact that the output is greater than probably it has ever been in the history of the trade; as, although there are only 46 furnaces in blast, the production is larger than was the case years ago, when ten more furnaces were blowing, as the output per furnace is now greater because of the heavier blast. The feature of the output is of course Bessemer qualities of metal, which are in large consumption on the part of steelmakers, as well as by others who produce material in which the best descriptions of metal are essential. Makers are very firm in their prices, because they are so fully sold forward, and because the demand is so fully maintained, not only on home account, but on foreign account, and America is now one of the largest buyers in the market. Prices are steady at 80s. per ton for mixed Bessemer Nos., net, free on board, and warrant iron is at 77s. 6d. net cash sellers, buyers at a penny less. Stocks have been slightly reduced during the month, and now stand at 321,951 tons, being an increase since the beginning of the year of 55,072 tons. Makers have but small stocks on hand, as most of the iron they hold is intended for use in the manufacture of steel in the district. The prospects of the trade are very good, and it is probable that the present activity in the market will at any rate be maintained for fully another twelve months.

Shipping.—The shipping trade at West Coast ports is very busily employed, as much of the business being done by makers is on shipping account. The exports of pig iron since the beginning of the year have reached 423,174 tons, and steel 438,218 tons, being a decrease of 24,814 tons of pig iron and 46,797 tons of steel. The freight market is strong, and shippers get good prices for both coastwise and foreign cargoes. Indeed the prospects of a continuance of a brisk export trade are so satisfactory and promising that new tonnage is being built, and further orders are the subject of present negociation.

City of London College—On Wednesday, October 4th, the City of London College Science Society held its first meeting of the session, when Professor Henry Adams, M.Inst.C.E., delivered his presidential address. As one of the original founders of the society he had taken great interest in its progress, and, succeeding such well-known men as Sir John Lubbock and Professor Logan Lobley, he hoped to maintain unimpaired the reputation the society had achieved. After giving some statistics of the science work of the college, he proceeded to give an account of the development of marine engineering and steam navigation, from the time when steam was first applied to propulsion, in the year 1543, to the launch of the *Oceanic* in the present year, and by means of diagrams showed several interesting comparisons. The entire tonnage of the world in ships amounts to between 27,000,000 and 28,000,000 tons, of which 20,000,000 tons are propelled by steam, and Great Britain owns nearly 12,000,000 tons out of the 20,000,000. Continuing, he said the young marine engineer of the present day has larger problems to face than his forefathers had, but he has also larger opportunities of arming himself for the fray. The last generation had chiefly to rely upon common sense and the results of its own personal experience, which made it observant of facts and distrustful of theory; the present generation finds nearly everything reduced to rules and formulæ, and is apt to look upon a college course as containing all that it is necessary to know. In his opinion, the practical side of engineering can only be learnt in manufacturers' workshops under bread-and-butter conditions, and the colleges should confine themselves to theory, which can be imparted in evening lectures and class work. The working hours may need some further modification to produce the best result, but where overtime is not required there ought to be no difficulty in a healthy lad giving three or four evenings per week to study and yet make full time at the shops under the present régime.

Institute of Marine Engineers.—The ninth annual dinner in connection with this institute will be held on Wednesday, November 15th, in the King's Hall, Holborn Restaurant, when the President, Sir James Lyle Mackay, K.C.I.E., will preside and deliver the Presidential address. The date of this event is somewhat later in the year than usual, and it is hoped that the alteration will be more convenient to members and friends.

Shamrock.—There having been much speculation on this side as to who painted the bottom of the *Shamrock*, Messrs. Suter, Hartmann, & Rahtjen's Composition Co., Limited, inform us that they have word from their American friends, the Rahtjen's American Composition Co., that the work of preparing the bottom for the races was done by them, her lead keel having been coated with Messrs. Hartmann's Rahtjen's improved composition (the Red Hand brand), and the remainder of the bottom polished,

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English

Swallow.—On September 18th there was launched at Hull, for the Hull and Netherlands Steamship Co., Limited, a steel schooner-rigged steamer of about 1,010 tons gross, named the *Swallow.*

Sardius.—On September 21st there was launched at Selby, for Messrs. Smith & Bacon, Grimsby, an iron steam ketch, named *Sardius.*

Clan Alpine.—On September 22nd Messrs. Doxford & Sons launched from their Pallion Yard, Sunderland, a large turret steamer, the *Clan Alpine.* She is the eleventh vessel of this type built for the Clan Line of Glasgow (Messrs. Cayzer, Irvine & Co.), and the fifty-third turret steamer now afloat. Dimensions :—355 ft. by 45 ft. 6 in. by 27 ft. 3 in. moulded. Her deadweight is 5,450 tons, and her speed 12 knots. Her engines, $25\frac{1}{2}$ in., 42 in., and 69 in., by 48 in., were also built by the firm. The *Clan Alpine* is classed British Corporation highest class, and as she left the ways was gracefully christened by Miss Greta Doxford.

Ullapool.—On September 23rd there was launched at Hull, for the Grimsby Union Steam Fishing Co., Grimsby, a steel steam ketch, named the *Ullapool.*

Dorothy.—On September 27th there was launched at Middlesbrough, for Messrs. W. Page & Co., of Milford Haven, a steel steam trawler of about 160 tons gross, named the *Dorothy.*

Menter.—On October 2nd there was launched from the yard of Mr. Joseph Scarr, Grovehill, Beverley, a steel barge of the following dimensions: —Length, over all, 90 ft., between perpendiculars; beam, moulded, 24 ft.; depth moulded, 8ft. 6 in.. and She was built to the order of Messrs the London Grain Elevator Co., of London, and is the third built for that firm. She was christened *Menter* on leaving the ways by Miss Hasslehurst, of Beverley.

Exmouth.—On October 4th Messrs. Richardson, Duck & Co., launched from their yard a steel screw steamer of the following dimensions :—Length over all, 352 ft. ; breadth extreme, 48 ft. ; depth, moulded, 28 ft. 4 in. ; deadweight carrying capacity about 6,500 tons. This vessel, which has been built to the order of Messrs. Anning Bros., of Cardiff, will class 100 A1 on Lloyd's register, and has been built under special survey. She is of the three-deck type, one deck laid, with poop, long bridge from foremast to mainmast, and topgallant forecastle. Accommodation for captain and passengers is provided in poop, officers and engineers being berthed in iron houses on bridge deck and crew in topgallant forecastle. A cellular double bottom and forward and aft peak tanks are fitted for water ballast, and equipment includes six steam winches, large horizontal donkey boiler, steam windlass, stockless anchors, steam-steering gear, &c. The engines, by Messrs. Blair & Co., Limited, have cylinders 25 in., 42 in. and 68 in. by 45 in. stroke, steam being supplied by two single-ended boilers, having a working pressure of 180 lbs. As the vessel left the ways she was christened *Exmouth* by Lady de Blaquiere.

Hirundo.—On October 4th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Limited, at Bill Quay, Newcastle-on-Tyne, a handsome new steel screw steamer which has been built to the order of Messrs. Watts, Watts, & Co., of Newcastle-on-Tyne, for Mr. Conrad Blumer Hofgaard, of Tonsberg, Norway. The vessel is of the following dimensions, viz. :—Length, 290 ft. ; breadth, 42 ft. ; depth, moulded, 21 ft. 9 in. ; and she is constructed on the improved single-deck type, with poop bridge and topgallant forecastle. Water ballast is provided in the cellular double bottom, all fore and aft, and in after peak tank. In addition to being built to Lloyd's 100 A1 class, she will also take the highest class in Norwegian Veritas. The vessel has also been inspected during construction by Mr. Norman Burnett, consulting engineer, Newcastle-on-Tyne, and by Captain Godtfred Olsen, of Tonsberg, Norway, who will take command of her when ready for sea. She will be rigged as a fore and aft schooner, with telescopic topmasts, and will be fitted with all the most modern description of deck machinery and other appliances for facilitating the rapid loading and discharging of cargo and general working and navigation. The saloon, captain's accommodation, &c., are in a large house on the bridge deck, amidships, having chartroom and wheel-house on flying bridge above, the officers' and engineers' accommodation being in side houses amidships; whilst the crew are berthed in the topgallant forecastle. The propelling machinery has been constructed and will be fitted by the North-Eastern Marine Engineering Co., Limited, at their Northumberland Engine Works, Wallsend-on-Tyne, and consists of a set of their triple-expansion engines of improved design, having cylinders $21\frac{1}{2}$ in., $35\frac{1}{2}$ in., and 58 in. diameter, respectively, with a stroke of 39 in., steam being supplied by two large steel multitubular boilers working at a pressure of 160 lbs. per square inch. The machinery has also been constructed to the requirements and under the special survey of both Lloyd's and Norwegian Veritas, for their respective highest classification. The ceremony of christening the vessel was performed by Mrs. Thomas E. Ruddock, of Gosforth, Newcastle-on-Tyne, who named the steamer *Hirundo.*

Andromeda.—On October 5th there was launched by Messrs. Eltringham & Co. at South Shields the first screw trawler for the Vedra Steam Fishing Co., Limited, named the *Andromeda.* The vessel was towed to Stone Quay, South Shields, where she will receive her boiler and engines, the former being by the builders of the hull, and the latter by Mr. G. T. Grey, of South Shields.

Denbighshire.—On October 5th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a handsome screw steamer built to the order of Messrs. Jenkins & Co., Limited, of London, for their Shire Line of steamers. The length of the vessel between perpendiculars is 356 ft. ; breadth, 45 ft. 2 in. ; and depth, moulded, 29 ft. 4 in., having large topgallant forecastle in which are berthed the sailors and firemen, and long bridge amidships, on the top of which is provided accommodation for captain, engineers, officers, and a few passengers. The saloon is tastefully fitted in polished oak with tiled floor, and replete with every comfort, whilst the full poop is entirely devoted to cargo. The vessel is constructed on the deep-frame principle, thus dispensing with hold beams, and has cellular water ballast all fore and aft. Poop, bridge, and forecastle decks are of wood, the main and spar decks of steel, her class will be 100 A1 Lloyd's, spar deck grade, special survey, also Board of Trade certificate. The vessel's deadweight carrying capacity is 6,000 tons. Deck machinery consists of nine large steam winches, by Messrs. J. Lynn & Co., of Pallion, direct steam windlass by Messrs. Emerson, Walker, & Thompson Brothers, Limited, and Messrs. Alley & MacLellan's steam-steering-gear, which is placed in the engine-room and worked from flying bridge, together with all the usual appliances for handling cargo and working the ship with the greatest possible despatch. The main engines are upon the tri-compound principle, by the North-Eastern Marine Engineering Co., Limited, Sunderland, and have cylinders 24 in., 40 in., and 64 in. by 42 in. stroke, steam being supplied by two large steel boilers working at a pressure of 170 lbs. per square inch. During construction the steamer has been inspected, on behalf of the owners, by Mr. C. E. Hudson, and upon leaving the ways was gracefully named *Denbighshire* by Mrs. Frank Jenkins, of London, after which she was towed into the South Dock for the purpose of masting and shipment of machinery.

Harriet.—On October 5th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz :—Length over all, 250 ft. ; breadth, 35 ft. 6 in. ; depth, 18 ft. 2 in. She has been built to the order of Mr. Martin Carl, of Copenhagen, and will take Lloyd's highest class. The deck erections consist of a long raised quarter-deck with full poop on top, short bridge, and forecastle, a handsome saloon, stateroom and accommodation for the captain will be fitted up in the poop, comfortable quarters for the engineers and officers in the bridge, and for the crew forward. The machinery is placed aft, leaving large clear cargo holds amidships. The hull is built with deep bulb frames, cellular double bottom, and ballast tanks in the after and fore peaks. Five steam winches, large patent donkey boiler, steam-steering gear placed in engine-room casing, hand screw gear aft, direct steam windlass, three masts, boats on beams overhead, grain divisions, and all improved appliances for working the steamer will be provided. The engines are of the three-crank triple-expansion type, and are from the Central Marine Engine Works of the builders, the cylinders being 18 in., $28\frac{1}{2}$ in., and $47\frac{1}{2}$ in. diameter, with 33 in. piston stroke, and a large steel boiler to work at a pressure of 160 lbs. per square inch. The steamer has been superintended during construction by Captain A. V. Knudsen on behalf of the owners, and the ceremony of naming her *Harriet* was gracefully performed by Mrs. Clement Owens, of Beckenham.

Loire.—On October 6th there was launched from the shipbuilding yard of Messrs. Robert Stephenson & Co., Limited, Hebburn, a finely modelled screw steamer, the second of two to the order of the United Steamship Co., of Copenhagen. The ship, which is of the raised quarter-deck type, is of the following dimensions:—Length between perpendiculars, 250 ft.; breadth moulded, 35 ft.; depth moulded to main deck, 18 ft. 4 in., and depth moulded to quarter-deck, 22 ft. 4 in. The ship, which is built to the highest class in Bureau Veritas, is to be fitted out for the French wine trade. She has a cellular double bottom all fore and aft for water ballast, and has upper and lower decks of steel. The bow has been specially strengthened for ice to obtain Veritas P.R. class. She has a vertical donkey boiler, four powerful steam winches, a steam windlass, and hand-steering gear. The crew are berthed forward under the top-gallant forecastle, and the saloon and staterooms, also the officers' and engineers' rooms, are in an upper bridge above the main bridge. All the rooms throughout are heated by steam. The engines, which are of the triple-expansion type, supplied with steam by two large single-ended boilers, are also supplied by the builders. The ship has been constructed under the supervision of Captain Rabe, and the engines under that of Mr. Fricke, the representatives of the owners. As the ship left the ways she was gracefully named *Loire* by the Mayoress of Newcastle-upon-Tyne.

Barendsz.—On October 7th this vessel, one of two steamers built to the order of Messrs. Van Vliet & Co., of Ymuiden, was launched from the builders' yard, Messrs. Cochrane & Cooper, Limited, of Selby. She has been built for trawling, and all the auxiliary machinery and appliances for her intended trade will be fitted. The principal dimensions are:—Length, 115 ft. 4 in.; breadth, 21 ft. 6 in.; depth, moulded, 11 ft. 6 in. The engines, building by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, of Middlesbrough, have cylinders 13 in., 21 in., and 34 in., with a 24 in. stroke, and will take steam from a large single-ended boiler at a working pressure of 180 lbs. The vessel throughout has been constructed to Lloyd's and Dutch Government requirements under the direct supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool.

Eros.—On October 7th there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons, for Tomaso Cossovich, of Trieste, a first-class steel single-deck steamer, built for the cargo trade. Her dimensions are:—Length, between perpendiculars, 313 ft.; breadth, 44 ft. 2 in.; and depth, moulded, 23 ft. ½ in. She is built on the deep-frame principle, with one deck laid, thus leaving large holds clear of all obstructions of beams and stringers, and is classed 100 A1 at Lloyd's. The vessel is designed to carry a large deadweight on a light draught of water, and is fitted with a poop aft, long bridge amidships, both for the carrying of cargo, and a top-gallant forecastle. The captain and officers are accommodated in a large house on the top of the bridge at the fore end, and the engineers in two side houses on the top of bridge deck at the after end; the petty officers and crew have quarters in the forecastle. Ample water ballast is provided in the cellular double bottom and in the after peak. There are five hatches, each worked by a powerful winch, with steam supplied from a large multitubular donkey boiler, thus enabling the vessel to be loaded and discharged very rapidly. She is schooner-rigged, with two masts, and has four boats raised on high chocks; steam-steering gear at after end of engine casing, and worked by control shafting from wheelhouse amidships. The engines are of the triple-expansion type, with cylinders 22 in., 36½ in., and 60 in. diameter, with a stroke of 42 in., two steel boilers of 180 lbs. pressure, built by the North-Eastern Marine Engineering Co., Limited. Both ship and engines have been designed with all the most modern improvements for a first-class cargo steamer. During construction the hull and machinery have been superintended by Mr. Baird and Captain Buntielic, who will take command. As the vessel left the ways she was gracefully christened *Eros* by Miss Lowes.

Panaghi Vagliano.—On October 7th there was launched at North Shields, for Messrs. Constantine, Svorcno & Sons, of Marianople, a steel schooner-rigged steamer, named the *Panaghi Vagliano*, of about 650 tons gross.

Quassia.—On October 7th there was launched at Grimsby for the North-Eastern Steam Fishing Co., Limited, of Grimsby, an iron steam trawler of about 185 tons, named the *Quassia*

Islanda.—On October 7th, Messrs. Sir Raylton Dixon & Co. Limited, launched from their Cleveland Dockyards, Middlesbrough, a fine cargo steamer, built to the order of the British India Steam Navigation Co., of London, for their Eastern trade. She is built to Lloyd's highest class, three-deck rule, her principal dimensions being:—Length, 424 ft. 6 in. by 50 ft. 8½ in. beam, by 32 ft.; and has a deadweight carrying capacity of about 8,000 tons on a light draught of water. The principal decks are of steel and iron, the upper deck being sheathed with teak. The water ballast will be carried in cellular double bottom all fore and aft, also in fore and aft peaks, and large deep tank in No. 3 hold. The vessel will be fitted up for a Board of Trade passenger certificate, and lighted throughout with electric light. Triple-expansion engines will be fitted by Messrs. T. Richardson & Sons, Limited, Hartlepool, having cylinders 26½ in., 42 in., 66½ in., by 51 in. stroke, supplied with steam by large single-ended boilers, working at 160 lbs. pressure, fitted with Howden's system of forced draught. On leaving the ways, she was gracefully named *Islanda* by Mrs. Clark, wife of Mr. J. Clark, superintendent engineer of the company. The vessel has been built under the personal supervision of Mr. Peter Barr, the resident representative of the owners.

Ruby.—On October 7th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler, of the following dimensions:—115 ft. 4 in. by 21 ft. by 11 ft. 6 in., depth of hold, built to the order of Messrs. T. C. & F. Moss, Grimsby. Engines of triple-expansion type will be supplied by Messrs. C. D. Holmes & Co., Hull, whilst the vessel will be replete with the most modern appliances for trawling. Mrs. Ethel Moss, of Grimsby, named the vessel *Ruby*, and after the ceremony the company adjourned to the offices of the builders for luncheon.

Spero.—On Saturday, October 7th, Messrs. S. P. Austin & Son, Limited, launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel-screw steamer *Spero*, which has been built to the order of Messrs. R. S. Gardiner and Joseph Reay, of the Pelton Steamship Co., Limited, Newcastle-on-Tyne. The vessel has a poop for the accommodation of captain and officers, raised quarter-deck, bridge-house, full forecastle, and her dimensions are:—Length between perpendiculars, 235 ft.; breadth, 34 ft. 3 in.; depth, moulded, 17 ft. 3 in, with Lloyd's special survey class of 100 A1. The *Spero* is specially adapted for the coal trade, of a type which this company has made a special feature in their business, with large self-trimming hatches, and arrangements are made for carrying a large quantity of water ballast to enable the vessel to perform her voyages without stoppage, in all kinds of weather, when without cargo. She has four powerful steam winches by Messrs. R. Roger & Co.; multitubular boiler for working deck machinery, by Cochran & Co.; patent quick-warping steam windlass by Emerson Walker & Co., steam-steering gear by Donkin & Co., screw-steering gear aft by Crawford & Sons, and the deadweight carrying capacity is estimated at 1,675 tons on a light draught of water. The machinery to drive the vessel, at a speed of about 10 knots in regular work, will be supplied by Messrs. George Clark, Limited, of Southwick Engine Works, Sunderland, and the ballast-pumping arrangements will be of a special character. The launch was successfully carried out in the presence of a number of friends of the builders and owners, and the vessel was named by Miss Annie Reay, of Newcastle-on-Tyne.

St. Lawrence.—On October 17th there was launched at Hull, from the yard of Earle's Shipbuilding and Engineering Co., Limited, a fine steel steam trawler, built to the order of the Grimsby Victor Steam Fishing Co., Limited. The vessel is 118 ft. 9 in. long over all, 21 ft. beam by 11 ft. 8 in. moulded depth, and will be fitted by the builders with triple-expansion engines, supplied with steam by a large steel boiler working at 180 lb. pressure. As the vessel left the ways she was gracefully christened *St. Lawrence* by Miss Gladys Coulson, the daughter of one of the directors of the Grimsby Company.

Swan.—On October 17th there was launched at Hull from the yard of Earle's Shipbuilding and Engineering Co., Limited, a fine single-screw cargo and passenger steamer for the Hull and Netherlands Steamship Co., Limited. This vessel, which was named the *Swan*, is 240 ft. in length, 23 ft. in breadth, and 16 ft. moulded depth; built of steel to Lloyd's highest class, and has a double bottom for water-ballast tanks in the main and after holds, and the forward and aft peaks are also fitted for water-ballast. She is arranged with a raised quarter-deck aft, a bridge over the machinery and boiler space, and forward has a topgallant forecastle. Under the quarter-deck is accommodation for 12 first-class passengers, with dining saloon, entrance and staircase to the cabin, pantries, &c., in a large steel house above. The saloon is fitted in polished hardwood, and the whole of the accommodation is carried out in very good style and with all conveniences. The captain's room and the chartroom are on the bridge, and the officers' and engineers' cabins are under the same at the after-end, the crew being berthed in the topgallant forecastle. Comfortable accommodation is also provided under the deck forward for 10 second-class passengers. The cargo appliances are arranged to give quick despatch in handling goods, and comprises four powerful steam winches with extra strong derricks and the necessary lifting gear, and stalls for 40 horses are fitted under the bridge. The ship is fitted with steam-steering gear amidships in the engine-room, and screw gear aft. The boats and life-saving appliances will be all in accordance with the requirements of the Board of Trade. Her machinery will consist of triple-compound three-crank engines, having cylinders 19 in., 32 in., and 52 in., diameter by 36 in. stroke, and two steel boilers 13 ft. diameter, by 10 ft. 6 in. long, to work at 160 lbs. steam pressure.

Mariposa.—On October 17th, this vessel was launched by Messrs. Joseph L. Thompson & Sons, Limited, of the North Sands Shipbuilding Yard, Sunderland, and has been built to the order of Messrs. T. Hogan & Sons, of Bristol and New York, and is the fifth vessel built by this firm from these owners. Her principal dimensions are:—Length, between perpendiculars 390 feet; breadth, extreme, 49 ft. 9 in.; depth, moulded, 30 ft. 8 in. She is built to Lloyd's highest class on the spar deck rules, and is especially constructed for the owners' North Atlantic trade. There is a poop aft and a long bridge, both arranged for carrying cargo. The accommodation for saloon, captain, officers, and engineers and a few spare berths, is all in a large house on the bridge amidships. The chief and second engineers are berthed in a large house placed on the after end of the bridge, the crew, fireman, and petty officers being berthed in the topgallant forecastle. The chart and steering house is arranged on top of the saloon house. The steam-steering gear is placed at the after end of the engine casings, with the controlling gear to this steering house. The vessel has a cellular double bottom throughout for water ballast; the after peak is also arranged for water ballast; there is also a large deep tank placed forward; also one abaft of the boiler room arranged for carrying water ballast, or cargo. The deck machinery consists of eight powerful steam winches, supplied with steam by a large multitubular donkey boiler, working at 180 lbs. pressure, and the cargo will be handled by double derricks placed on each mast; a patent steam windlass is fitted on the forecastle head, and a powerful screw gear aft. The vessel is rigged as a two masted fore and aft schooner, and is complete in every respect as a high class modern cargo carrier. The engines and boilers have been constructed by Messrs. Blair & Co., Limited, of Stockton-on-Tees, the sizes of the cylinders being:—25 in., 43 in., 73 in., by 48 in. stroke, supplied with steam by three large multitubular boilers working at 200 lbs. pressure. The vessel has been constructed under the personal supervision of Captain Thomas H. Gore, the owners representative in this country. The launch, which was most successful, was affected by means of hydraulic power, and was gracefully christened by Mrs. T. H. Gore, of Bristol. There were also present Mrs. Robert Thompson, Madame Lechere, of Antwerp; Miss Andrew, Mrs. P. Phorson, Captain T. H. Gore, Captain J. Jenkins, Captain David Jenkins, Mr. Lund, of London; Mr. E. Pinkney, Mr. K. Pinkney, and the members of the builders' firm. After the launch the company adjourned to the firm's luncheon room, where the usual toasts were duly honoured.

Everingham.—On October 18th the Blyth Shipbuilding Co., Limited, launched from their shipbuilding and graving dock works at Blyth, a steel screw steamer of the following dimensions:—Length, 337 ft.; breadth, 47 ft.; depth, 24 ft. 10 in. This vessel has been built to the order of Messrs. Alex. Meek & Sons, of Goole, and will class 100 A1 at Lloyd's. She is of the three deck type, with single deck laid, having poop, bridge, and topgallant forecastle. The cabin accommodation for captain and officers is fitted in house on bridge, the engineers in sidehouses on bridge, and the crew in forecastle. Her equipment includes stockless anchors, five steam winches, large donkey boiler, steam windlass with detachable warping gear, steam-steering gear, and all the latest appliances for the speedy and safe working of the vessel. Triple expansion engines of good power will be supplied and fitted by Messrs. Blair & Co., Limited, of Stockton. As the vessel left the ways she was named *Everingham*, by Miss Rosa Meek. The vessel and machinery have been constructed under the inspection of Messrs. J. Jamieson & Co., of Hull.

Runo.—On October 19th there was launched by Sir James Laing at Sunderland a spar-decked steamer named the *Runo*, which has been built to the order of the Neptune Steam Navigation Co. Her dimensions are:—Length over all, 400 ft.; breadth, 46 ft. 6 in.; depth, 29 ft. 6 in. She has a carrying capacity of 6,000 tons, and will be engined by Messrs. Richardson, of Hartlepool, with engines of 2,500 H.P., guaranteed to give a speed of $11\frac{1}{2}$ knots. This vessel, which is the seventeenth, representing 44,000 tons, that has been built by Sir James Laing for the Neptune Line, will run between Baltimore and Rotterdam.

Etruria.—On October 19th Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a very fine steel screw steamer of the following dimensions, viz., 274 ft. by 35 ft. by 23 ft. 8 in., moulded, to the spardeck type, with poop, long bridge, and topgallant forecastle, water ballast in double bottom fore and aft and in peaks. She is built on the deep-frame principle to Lloyd's highest class, under special survey, and also to the German law requirements. Her equipment consists of patent direct steam windlass, patent steam-steering gear, four large double-powered steam winches, large donkey boiler, stockless anchors, and all the latest improvements. The propelling machinery has been constructed by Messrs. T. Richardson & Sons, Limited, Hartlepool, the cylinders being 22 in., 35 in., 59 in., by 39 in. stroke, with two large boilers working at 160 lbs. pressure. This vessel has been built to the order of Messrs. A. C. de Freitas & Co., Hamburg, under the superintendence of Mr. Heinrich Wiengreen and Mr. M. Rother. The ceremony of christening the vessel *Etruria* was gracefully performed by Mrs. W. Ford, of Ingleside, Stockton. This is the fifth vessel that Messrs. Craig, Taylor & Co. have built for Messrs. A. C de Freitas & Co., and they have a sister vessel constructing for the same owners.

Gadsby.—On October 19th Messrs. Ropner & Son, of Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 325 ft.; breadth, extreme, 48 ft.; depth, moulded, 24 ft. 3 in. The vessel will take the highest class at Lloyd's, and is built on the three-decked rule, having poop, very long bridge, and topgallant forecastle. She has been built to the order of Messrs. Ropner & Co., West Hartlepool. The accommodation for captain and officers will be fitted up in the poop, and for engineers and apprentices in iron houses on the bridge deck, the crew being berthed in the forecastle as usual. The vessel has double bottom on the cellular principle for water ballast, also in fore and after peaks. She will carry a deadweight cargo of about 5,280 tons, and is fitted with all the most recent appliances for the expeditious loading and unloading of cargoes, has direct steam windlass, steam steering gear amidships, with powerful screw gear aft, and is also supplied with six large steam winches driven by two donkey boilers. The vessel will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of about 1,100 I.H.P. The christening ceremony was gracefully performed by Miss Elsa Ropner, of Preston Hall, who gave the vessel the name of *Gadsby*.

Sandsend.—On Thursday, October 19th, Messrs. William Gray & Co., Limited, launched the large steel screw steamer *Sandsend*, built to the order of the Pyman Steamship Co., Limited, of West Hartlepool. The vessel takes Lloyd's highest class under special survey, and her dimensions are:—Length over all, 385 ft.; breadth 49 ft. 6 in., and depth 28 ft. 3 in. The deck erections consist of a full poop, long bridge, and topgallant forecastle. The saloon, and captain's and officers' rooms are located in the poop, and the engineers' rooms are in houses on the bridge deck. The hull is built with deep frames, and cellular double bottom and aft peak for water ballast, powerful steam winches, steam-steering gear amidships and hand-screw gear aft, patent direct steam windlass, two large donkey boilers, grain divisions, stockless anchors, and a complete outfit will be fitted for a first-class cargo steamer. Three cylinder triple-expansion engines are being supplied by the Central Marine Engine Works, of Messrs. William Gray & Co., Limited; they will develop over 1,400 H.P. The cylinders are $25\frac{1}{2}$ in., $46\frac{1}{4}$ in., and 67 in. diameter, with a piston stroke of 45 in., and large steel boilers constructed for a working pressure of 180 lbs. per square inch. The hull and machinery have been built under the superintendence of Mr. Cromar on behalf of the owners.

Sebriana.—On October 20th Messrs. Short Brothers launched from their works at Pallion a handsomely-modelled steel screw steamer, built to the order of the British Maritime Trust, Limited, of London, of which Sir E. T. Gourley, M.P. for Sunderland, is a director. Her principal dimensions are:—Length, 372 ft.; breadth, 48 ft.; and depth, moulded, 30 ft. 10 in. The vessel is built of steel to the highest class in Lloyd's register under special survey. The framing being on the improved deep-frame principle leaves the holds clear of obstructions. The vessel is fitted with a cargo poop, long bridge amidships, on which is fitted up houses for the accommodation of the captain and officers, with saloon, messrooms, &c. A commodious topgallant forecastle is fitted up for the accommodation of the crew. The holds are four in number, with eight powerful steam winches; steam-steering gear is fitted at the after end of the engine platform, with controlling rods from flying bridge. The bottom is of cellular construction, divided into six compartments for water ballast, the after peak being also fitted as a trimming tank. Every attention has been given in the arrangements of the vessel for the quick loading and discharging of cargoes, and the appliances are of the latest pattern. On leaving the ways the vessel was named *Sebriana* by Mrs. A. H. Walker, of West Hartlepool. The vessel is to be fitted with triple-expansion engines by Messrs. W. Allan & Co., Limited, of Sunderland, having cylinders 25 in., 41 in., 69 in. diameter, with a stroke of 48 in., steam being supplied by three large steel boilers working at 180 lbs. pressure.

Heemskerk.—On October 21st this vessel building to the order of Messrs. Van Vliet & Co., of Ymuiden, by Messrs. Cochrane & Cooper, Limited, was launched from their yard at Selby. She has been specially constructed for trawling and all the necessary auxiliary appliances for her trade will be fitted. The principal dimensions are:—Length, 115 ft. 4 in.; breadth, 21 ft. 6 in.; moulded depth, 11 ft. 6 in. The vessel will be fitted with triple-expansion engines by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, of Middlesbrough, having cylinders 13 in., 21 in., and 34 in., with a 24 in. stroke, and will take steam from a large single-ended boiler at a working pressure of 180 lbs. The vessel throughout has been constructed to Lloyd's and the Dutch Government requirements, under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool.

Oro.—On October 21st Messrs. Sir Raylton Dixon & Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw steamer. built to the order of Messrs. Gellatly, Hankey & Co., of London. She is built to Lloyd's highest class spar deck rule, her principal dimensions being length 352 ft. 4 in., breadth 47 ft., depth moulded 25 ft. 9 in., and has a deadweight carrying capacity of about 5,300 tons on a light draught of water. The spar and main decks are of steel and iron, and poop, bridge, and forecastle deck, of pitch pine. Triple expansion engines will be fitted by Messrs. Sir C. Furness, Westgarth & Co., Limited, of Middlesbrough, having cylinders 25 in. 40 in., 66 in. by 45 in. stroke, with two large single ended boilers working at 180 lbs. pressure and fitted with Howden's system of forced draught. The vessel and machinery have been built under the supervision of Captain John, superintendent for the owners. On leaving the ways she was gracefully named *Oro*, by Miss Jean Kennedy, the young daughter of Mr. Walter Kennedy, agent for Messrs Gellatly, Hankey & Co. in Middlesbrough.

Shamrock.—On October 21st Messrs. Cochrane & Cooper, Limited, launched from their Grovehill shipyard, Beverley, a new steam-trawler of the following dimensions:—100 ft. by 21 ft. by 11 ft. depth of hold, built to the order of Messrs. E. & R. Osborne, Grimsby. Messrs. C. D. Holmes & Co., of Hull, are supplying engines of the triple expansion type. The vessel will be completed ready for sea and will be replete with the most modern appliances for trawling. Mrs. R. Osborne, of Grimsby, named the vessel *Shamrock*, and among the company were Mr. and Mrs. C. A. Osborne, Miss J. Osborne, Mr. and Miss Southern, Mr. and Miss Fearn, and Mrs. Shaw. After the ceremony the company adjourned to the Beverly Arms, for breakfast,

Hornby Castle.—Lately Messrs. William Pickersgill & Sons, Southwick, Sunderland, launched from their yard, a finely modelled steel screw steamer built to the order of Messrs. J. Chambers & Co,, Liverpool, Her dimensions are as follows:—Length 361 ft. by 46 ft. 3 in. by 28 ft. 2 in. She has been built under special survey to take Lloyd's highest class as a spar decked steamer. The hull is built on the deep frame principle, and fitted with cellular double bottom throughout for water ballast, the after peak being also used for this purpose, the scantlings have been so much increased to enable her to claim what is practically a three-decked freeboard, which will allow of her carrying a good deadweight cargo on a moderate draught. A large steel deck-house on bridge affords accommodation for saloon captain and officers' berths, the saloon will be tastefully fitted up in oak. The engineers' berths are fitted up in steel houses on bridge deck, the petty officers and crew are berthed under topgallant forecastle. The vessel will be rigged as a two-masted fore and aft schooner, having steel lowermasts and wood telescopic topmasts, she is to be fitted with seven steam winches by Messrs. Clarke, Chapman & Co., Gateshead, steam-steering gear by Messrs. J. Lynn & Co., Limited, Sunderland, which is fitted in a house abaft engine casing, steam windlass by Messrs. Emerson, Walker & Thompson Brothers, and a large multitubular donkey boiler by Messrs. Riley Bros. She has been specially designed with a view to rapid loading and discharging of cargo, and is provided with five large hatchways worked by extra strong derricks and derrick gear, in addition to two derrick posts amidships for working aft end of main hold. She will be equipped in a thoroughly efficient manner, with all the latest appliances necessary for a first-class modern cargo steamer. The machinery and boilers are being supplied by Messrs. George Clark, Limited, of Southwick, Sunderland, the engines are of the triple expansion type, with cylinders 23½ in., 40 in. and 67 in. diameter, by 45 in. stroke and two large steel boilers with a working pressure of 180 lbs. fitted with Howden's forced draught. During construction the vessel and engines have been under the personal superintendence of Mr. E. H. Bushell, consulting engineer of Liverpool, she is now being completed under the supervision of Captain Jackman, who will take command on completion. After the launch, the *Hornby Castle* proceeded to the engineers to receive her machinery.

LAUNCHES—Scotch.

Leven, **Mersey**, and **Nidd.**—On September 4th Messrs. Mackie & Thomson launched at Govan three screw fleeters which they have built for Messrs. James Leyman & Co., Hull. The dimensions of each are:—Length, 105 ft.; breadth, 21 ft.; depth, moulded, 11 ft. 7 in.; tonnage, 180 gross. Triple-expansion engines of 250 I.H.P. will be supplied by Messrs Muir & Houston, Kinning Park. The vessels were named the *Leven*, by Mrs. Somerville Letten, Grimsby; the *Mersey*, by Mrs. George Watson, London; and the *Nidd*, by Mrs. R. B. Macouat, Arden, Jordanhill.

Dale.—On September 19th there was launched at Aberdeen, for the Dee Line Steam Fishing Co., Grimsby, an iron steam ketch of about 180 tons gross named the *Dale*.

Adato.—On September 26th Messrs. William Hamilton & Co. launched from their Newark Yard, Port-Glasgow, a steel screw steamer for Messrs. Andrew Weir & Co., 102, Hope Street, Glasgow, for their Eastern and general trade. The dimensions of the vessel are as follow:—Length between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in.; with poop, long bridge amidships, and topgallant forecastle for crew, and the vessel is classed in Lloyd's 100 A1 spar deck. She is designed to carry a weight of 5,400 tons on a light draught of water, with a net register tonnage of about 2,100 tons. The propelling machinery, which is being supplied by Messrs. Dunsmuir & Jackson, of Glasgow, consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 65 in. diameter respectively, by 42 in. stroke, steam being supplied by two large boilers constructed for a pressure of 180 lbs. The steamer was named the *Adato* by Mrs. M'Intyre, the wife of the captain. The owners were represented at the launch by Captain M'Intyre, who is to command the vessel. Immediately after the launch, which was most successful, the vessel proceeded to the Prince's Dock, Glasgow, to receive her machinery.

The Duchess.—On September 26th the Ailsa Shipbuilding Co. launched from their yard at Troon a steel screw steamer, classed 100 A1 at Lloyd's, for Messrs. J. Hay & Sons, Glasgow. The steamer is intended for the coasting and Continental trade, and is of the following dimensions:—Length, 184 ft.; breadth, 27 ft.; and depth, moulded, 13 ft. 5 in. Compound surface-condensing engines, with cylinders 21 in. and 44 in. diameter by 30 in stroke, will be fitted by Messrs. Muir & Houston, Limited, Glasgow, The ceremony of naming the vessel *The Duchess* was performed by Mrs. Hay, 44, Windsor Terrace, St. George's Road, Glasgow.

Sardinero.—On September 27th the Campbeltown Shipbuilding Co. successfully launched a steel screw steamer of 3 400 tons deadweight, single-deck type, built to the highest class at Lloyd's, for Spanish owners. The vessel is intended for general trading. On leaving the ways she was named *Sardinero* by Miss Waite, Springbank, Campbeltown. The engines will be supplied by Messrs. Hutson & Son, Kelvinhaugh Works, Glasgow.

Advice.—On October 2nd the London and Glasgow Engineering and Shipbuilding Co., Limited, Govan, launched the first of two paddle tugs which they are constructing for the British Admiralty. The vessel is fitted with all the latest and strongest appliances for towage purposes, and she has been constructed so that she may be of great service in shallow water. Her principal dimensions are:—Length, 144 ft.; breadth, 27 ft. 3 in.; and 700 tons displacement. The engines and boilers, which are also supplied by the builders, are to develop 1,250 I.H.P. The vessel was named *Advice.*

Hyson.—On October 4th there was launched from the yard of Messrs. David & William Henderson & Co., Partick, a large handsomely modelled steel screw steamer, which they have built to the order of the China Mutual Steam Navigation Co., Limited, London. The dimensions of the vessel are 465 ft. by 53 ft. by 34 ft., with a gross tonnage of about 6,500 tons. The vessel has a large carrying capacity, and has been specially designed to suit the extensive Eastern trade of the owners, has been built under special survey to class 100 A1 at Lloyd's, and in addition will have a Board of Trade passenger certificate. Sixteen powerful steam winches have been fitted, with large derricks, and all the latest improvements for the rapid handling of her cargo. The vessel is constructed with poop, long bridge and forecastle, the saloon and captain's accommodation being on the bridge deck. The accommodation for engineers and officers is of a superior style, and is also fitted on the bridge deck, alongside the engine casing. A complete installation of electric light has been fitted throughout the vessel by Messrs. W. C. Martin & Co., Glasgow; steam-steering gear by Messrs. Davis & Co., London, and a powerful capstan windlass on the forecastle head by Messrs. Emerson, Walker & Co. She will be rigged as a fore and aft schooner, with two telescopic pole masts to suit the Manchester Canal. Water ballast is carried all fore and aft, including the fore and after peaks, with a large deep tank for trimming purposes. The engines, which are of the triple-expansion type, have been constructed by the builders, and consist of three cylinders 28½ in., 47 in. and 78 in. by 60 in. stroke, with two double-ended boilers with Howden's forced draught and built for a working pressure of 180 lbs. Throughout the construction of the vessel, the hull and machinery have been under the personal supervision of the owners' representatives, Captain John S. Hogg for the hull and Mr. H. Seal for the engine department. This latest addition to the extensive fleet of the China Mutual Co. was gracefully named *Hyson*, as she left the ways, by Miss McLean, daughter of David McLean, Esq., Kensington Court, London.

Clonallon.—On October 6th Messrs. John Fullerton & Co. launched at Paisley a steel screw steamer, about 350 tons, which has been built to the order of Messrs. Joseph Fisher & Sons, Newry, for their extensive coasting carrying trade. The steamer is largely in excess of Lloyd's requirements, and has the most modern outfit for working both ship and cargo. Compound engines of 450 I.H.P. are being supplied by Messrs. Hall-Brown, Buttery & Co., Govan. The steamer was named *Clonallon* by Mrs. James Fullerton, Abbotsburn, Paisley. This is the eleventh steamer built by Messrs John Fullerton & Co. for the same owners, and has been superintended during construction by Mr. Edward Connolly, engineer, Newry.

Stirling Castle.—On October 7th there was launched from the shipbuilding and engineering works of Messrs. John Scott & Co., Kinghorn, a beautifully modelled paddle steamer to the order of the Galloway Saloon Steam Packet Co., Leith. The vessel is 170 ft. long between perpendiculars, 24 ft. broad, and 7 ft. 9 in. deep, moulded to main deck, and has been built under the superintendence of Mr. Harris, to highest class of Board of Trade. The steamer has been built for the Stirling passenger service of the company, and has a handsomely furnished saloon at the after end fitted up in solid oak, and upholstered in Utrecht velvet; dining and bar accommodation has also been provided for both first and second class passengers, and a smoking room all beautifully finished and lighted with electric light by Messrs. M'Ewan Clarke & Co., Edinburgh. The vessel is propelled by compound diagonal disconnecting engines, and steam is provided by one large single-ended marine boiler under forced draught. As the steamer left the ways she was gracefully named the *Stirling Castle* by Miss Galloway, daughter of M. P. Galloway, Esq., of the Galloway Saloon Steam Packet Co. The engines during construction have been superintended by Mr. Richard Young, of the London and Edinburgh Steamship Co. After the launch, the builders entertained a large company to cake and wine, when the usual toasts, &c., were duly proposed and honoured. Meanwhile the *Stirling Castle*, having been launched with steam up, had got under way and after having her compasses adjusted, proceeded to Burntisland.

Assaye.—On October 7th Messrs. Caird & Co., Limited, launched at Greenock a large steamer to the order of the Peninsular and Oriental Company. The ship's gross tonnage is about 7,300 tons, and, in addition to taking 2,000 tons of coal in her bunkers and reserves, she has large cargo capacity, whilst her displacement will not be less than 12,600 tons. Her total length is 450 ft., with a breadth of 54 ft., and the I.H.P. is such as to result in a sea speed of 16 knots. A special feature in the ship is that she has three promenade decks in addition to the navigating bridge, giving something like 50,000 superficial feet of promenade space; whilst to provide for bad weather the passage arrangements will allow travellers to pass under cover from one end of the ship to the other. There is accommodation for 114 first and 57 second saloon passengers, all provided in roomy cabins on the upper and hurricane decks. The dining saloon is on the upper deck, whilst the drawing and smoking rooms are on the hurricane deck. This ship, which was named the *Assaye*, is intended, along with her sister-ship the *Sobraon*, for the company's mail and passenger lines, and they will take their place in the company's programme, the former leaving London towards the end of the present year. The *Assaye* has twin screws, whilst altogether 22 boats will be carried, notwithstanding the exceptional subdivision of the vessel by watertight bulkheads into watertight compartments. She will be rigged with two pole masts. Messrs. Caird & Co. will themselves supply the engines which will be on the triple-expansion principle. Mrs. Alexander Tweedie, of London, the well-known authoress, performed the naming ceremony in a graceful manner. The *Assaye* was afterwards towed round to the Victoria Harbour.

Kaffir.—On October 10th there was launched from Messrs. William Jacks & Co.'s Broomhill Boat Slip, Port Dundas, a steel screw lighter of 100 tons deadweight capacity. The lighter is intended chiefly for carrying the builders' iron on the Forth and Clyde Canal. The engines are being supplied by Messrs. Shanks, Anderson & Co., Polmadie, and the boiler by Messrs. John Wallace & Co., Barrhead. As the boat left the ways she was named the *Kaffir* by Mrs. John Dick, Grangemouth.

Glynn.—On October 10th there was launched from the yard of the Ailsa Shipbuilding Co., Troon, a finely modelled steel screw steamer, built to the highest class at Lloyd's for Irish owners, and of about 1,000 tons register. The engines, which are of the triple-expansion type, are being supplied by Messrs. Muir & Houston, Limited, Glasgow. The vessel has three steam winches, steam windlass, steam and hand steering gear, steam capstan, and all the latest appliances for the loading and discharging of cargo, and for the safe navigation of the vessel. As the vessel left the ways she was gracefully named *Glynn*, by Miss Wilson, Kelburne, Fairlie.

Hibernia.—On October 10th the twin-screw steamer *Hibernia* was launched from the Leven Shipyard of Messrs. William Denny & Brothers, Dumbarton. The launching ceremony was performed by Lady Houldsworth, wife of Sir W. H. Houldsworth, Bart., M.P., who is a director of the company. Immediately after the launch, which was most successful, the party adjourned to the Model Hall, where lunch was partaken of. The success of the vessel and her owners, the London and North-Western Railway Co., was cordially pledged, and thereafter the health and long life of the lady who so gracefully performed the ceremony, was proposed by Mr. Peter Denny.

replied to by Sir William Houldsworth. The *Hibernia* is virtually a sister ship of the *Cambria*, built by the same builders, and delivered to the company in December, 1897. This vessel was fully described in our September, 1897, and January, 1898, issues, so we need only remind our readers of the leading particulars. In brief, then, the *Hibernia* is a twin-screw steamer having a length of about 340 ft., beam 39 ft., and a depth of 24 ft. to the awning deck. She is practically a passenger steamer, carrying only parcels and passengers luggage, and is intended to take her place along with the *Cambria* and her sister ship the *Anglia* (which is still on the builders' stocks, and will be launched in the course of a month), on the company's Holyhead and Dublin service. The first-class passengers are accommodated on the upper main and lower decks amidships, and forward of the machinery in handsome staterooms and open saloons, special provision being made for separate ladies' staterooms and retiring-rooms. The saloon is on the main deck, is handsomely finished in oak, and can accommodate a large number of passengers. Berths are fitted for 214 first class passengers, and all the usual conveniences have been carefully attended to, ample ventilation and lighting having been made a speciality. The steerage passengers are accommodated aft in a long poop and on the lower deck. Here again the ladies' wants are carefully attended to, a separate saloon being fitted for them, with lavatories attached. The whole of the awning deck forms a handsome promenade at the after end for the steerage, amidships and forward for the first-class passengers. This vessel will no doubt be as speedy as the *Cambria*, which on trial attained a maximum speed of 22 knots on the measured mile, and 21·35 on the 100-knot course. The *Cambria* is quite famous for the regularity of passages, and has become a favourite ship. This is the fifth vessel built by Messrs. William Denny and Brothers, who have been entrusted with the contract of practically renewing the company's fleet of mail steamers, the *Rostrevor*, *Connemara*, and *Galtee More* being employed on the Holyhead and Greenore line, whilst the *Cambria*, *Hibernia*, and *Anglia* are, or will be, employed upon the Holyhead and Dublin line.

Cuzco.—On October 10th there was launched from the yard of Messrs. Napier & Miller, Limited, Yoker, a steel screw steamer, built for Messrs. W. R. Grace & Co., of London and New York. Her dimensions are:—Length, 375 ft.; breadth, 50 ft.; and depth 28 ft. 8 in., moulded, with a gross tonnage of about 4,500 tons. The vessel is designed to carry a deadweight of fully 7,000 tons, with large hatches and eight powerful steam winches; also double derricks at each hatch stepped on strong derrick tables, thus making an efficient arrangement for the rapid handling of cargo. She has been constructed to Lloyd's 100 A1 three-deck rule with poop, bridge, forecastle, and with large capacity for water ballast in double bottom and in after peak, all accommodation being placed in houses on top of bridge deck, and the crew as usual being berthed in topgallant forecastle. A complete installation of electric light is fitted, also steam windlass and steam-steering gear. The engines have been constructed by Messrs. D. & W. Henderson & Co., and consist of three cylinders, 52 in., 41 in., and 67 in. in diameter respectively, with a piston stroke of 48 in. The two boilers are single-ended, with a working pressure of 200 lbs. to the square inch, and with Howden's system of forced draught. Both hull and machinery have been constructed under the supervision of Mr. Thomas Todd, consulting engineer, of Fenchurch Street, London. On leaving the ways the vessel was named *Cuzco* by Mrs. Henry Napier, Milton House. Bowling.

Pena Castillo.—On October 11th Messrs. Archibald McMillan & Son, Limited, Dumbarton, launched the steel screw steamer *Pena Castillo*, which they have built for the Compania Santanderina de Navegacion, of Santander. Her dimensions are 270 ft. by 37 ft. by 20 ft. 6 in. Her tonnage is 1,610 tons, and her carrying capacity 2,700 tons.

Seagull.—On October 19th Messrs. Mackie & Thomson, Govan, launched a steel screw steamer which they have built for Messrs. Leach & Co.. London. Dimensions:—Length, 225 ft.; breadth, 33 ft.; depth, 16 ft. 6½ in.; tonnage, 1,100 gross. Triple-expansion engines of 1,000 I.H.P., with two large steel boilers, will be supplied by the North-Eastern Marine Engineering Co., Limited, Sunderland. The vessel, which was built under the superintendence of Captain Lumley on behalf of the owners, was named the *Seagull* by Mrs. R. H. B. Thomson, Blawartlea, Scotstounhill.

Kokine.—On October 20th there was launched by the Grangemouth Dockyard Co., from their shipbuilding yard at Grangemouth, the second of two oil-tank steamers for the carriage of petroleum in bulk, built to the order of Messrs. Jacobs & Barringer, of London, for clients in the East. The dimensions are 355 ft. by 32 ft. 6 in. by 24 ft. moulded, and she has been built to the highest class at Lloyd's spar-deck rule, and is provided with all the most modern appliances for a vessel of this type, including two powerful pumps, capable of discharging 180 tons each per hour; air fan for exhausting inflammable vapour from the holds, apparatus for steaming out the holds in case of fire, electric light, steam-steering gear of horizontal type, and quick-warping steam windlass. The vessel is subdivided into 18 compartments, of which 14 are oiltight for the carriage of oil cargo in bulk. These holds are also fitted for carrying general cargo if required, being provided with large composite hatches, steam winches, and derricks. Throughout she is designed for service in tropical waters, having teak decks, double awnings, and a complete system of ventilation. Triple-expansion engines for a high rate of speed will be fitted aft, the boilers being arranged for coal or oil fuel, the latter of which will be used for ordinary service. The ceremony of naming the vessel *Kokine* was gracefully performed by Miss Vary Finlay, daughter of Mr. Finlay, London.

LAUNCH—Irish.

Rathlin Head.—On October 17th there was successfully launched from the North Yard of Messrs. Workman, Clark & Co , Limited, Belfast, a fine steel twin-screw steamer, named the *Rathlin Head*, built to the order of the Ulster Steamship Co., Limited, Belfast, Messrs. G. Heyn & Sons, managers. The dimensions of the vessel are:—Length between perpendiculars, 470 ft; breadth, 53 ft.; depth, 35 ft. 6½ in.; about 6,740 tons gross, and 4,440 net register, and carrying capacity of about 9,650 tons deadweight. The steamer will be classed 100 A1 at Lloyd's, under special survey, with machinery certificate. The vessel is built under the three-decked rule, considerably in excess of Lloyd's requirements; has long forecastle, long bridge house amidships, extending from side to side of the vessel, forming a complete protection for engine and boiler casings, &c., a long poop aft, and a permanent fore and aft centre bulkhead have been fitted in the lower holds, ensuring safety against cargo shifting. There are six cargo holds, all of about equal capacity, and seven hatchways, each with double derricks. Ten powerful steam winches by Messrs. John H. Wilson & Co., of Liverpool, fitted with the company's specialities, are provided for the rapid and careful handling of their general cargoes; Wilson's latest and improved make of steam windlass is placed in forecastle, with independent gear to work two powerful warping capstans on forecastle deck; and Pirrie & Wilson's patent spring tiller, and direct steam-steering gear, by the Harrison Steering Engine Co., is fitted aft with controlling rods from bridge. The *Rathlin Head* is built on the cellular double-bottom principle, having capacity for about 1,650 tons water ballast, to enable the vessel to make winter passages light across the Atlantic, with large trimming tank aft, fitted for cargo; is fore and aft rigged, with two steel masts (telescopic topmasts) and four derrick posts (fitted as ventilators); has two complete heavy steel decks, and bridge deck of steel, covered with pine. Saloon and accommodation for captain and a few passengers are arranged in large house on forward end of bridge deck, with charthouse and wheelhouse above on flying bridge. Engineers' and officers' rooms are on after end of the bridge deck; petty officers are accommodated in the forecastle, and the crew in poop. The steamer will be fitted throughout with a very complete installation of electric light, including powerful arc lamps for working cargo, &c., by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne. The engines and boilers, which have also been constructed by Messrs. Workman, Clark & Co., consist of two sets of three-crank triple-expansion type with latest improvements, to indicate about 3,200 H.P., with 200 lbs. working pressure, steel shafting and two Atlas bronze propellers. Steam is supplied from four single-ended boilers, with Howden's patent system of forced draught. The *Rathlin Head* is a fine specimen of the most modern type of cargo steamer. The vessel and her machinery have been constructed under the supervision of Mr. Hugh Wisnom, the company's superintendent engineer. She will be commanded by Captain Thomas McCalmont, commodore of the Head Line, who has been connected with the company since its formation. This is the fifth vessel built by Messrs. Workman, Clark & Co. for the Ulster Steamship Co,, who now own a fleet of 13 high-class cargo steamers, 11 of which have been built in Belfast. The *Rathlin Head* is intended to leave next month for New Orleans to load on the company's line for Belfast and Dublin.

LAUNCH—German.

Korea.—On Thursday, October 12th, a fine steel screw passenger and cargo steamer, built by the Flensburg Shipbuilding Co., to the order of the Ostasiaske Kompagnie, of Copenhagen, was safely launched. Her principal dimensions are:—428 ft. by 49ft. 8 in. by 30 ft. 6 in. moulded, having a deadweight carrying capacity of about 7,000 tons. She is classed to Lloyd's 100 A1 "spar-deck rule," having long poop and forecastle. Amidships are placed two large deckhouses for first-class passengers. The saloon is built to accommodate 30 persons, and is handsomely fitted up in oakwood framing, having oil paintings from different Danish painters. The passengers' cabins will have all the latest improvements, and smoking-room will be fitted in oakwood, with panels of Dutch plates. The captain's rooms and charthouse will be situated in the upper deck house, whilst the officers and engineers will be accommodated in house abaft engine casing—petty officers' accommodation being in house on poop aft. Croom & Arthur's patent direct steam-steering gear will be fitted with controlling shaft from pilot bridge amidships, and the vessel will be fitted throughout with electric light and telephone communication, and one of Messrs. Hall's large refrigerating machines. Triple-expansion engines, having cylinders 28½ in., 47½ in., and 78 in. by 54 in. stroke, with four large boilers capable of giving the necessary steam, will be supplied by the Engineering Department of this firm. As the vessel left the ways she was christened *Korea* by Frau Berentzen, the wife of the captain. The vessel is at present under the Danish, but when completed will be transferred to the Russian flag. The launch was effected by the use of Mr. Phorson's patent launching trigger, which was used by the firm for the first time on this occasion, and was found to act excellently, assuring as it does the safe launching of vessels. Mr. Phorson, the patentee (Messrs. J. L. Thompson & Sons, Limited), Mr. J. A. Thompson, and Mr. L. Marr paid a visit to the yard, and after the lunch the chairman of the company, Mr. Andresen, and Mr. Bredsdorff, the managing director, in a toast to Mr. Phorson, paid a special tribute to that gentleman with regard to the value of his invention.

LAUNCH—Norwegian.

Alma.—Lately a steel cargo screw steamer was launched by the Laxevaags Engineering and Shipbuilding Co., Bergen, Norway. The vessel is of the following dimensions:—Length over all, 235 ft.; breadth, 32 ft.; depth, 15 ft. 8 in. The vessel has been built to the order of Mr. D. W. Ellerhusen, Bergen, Norway, and to Norwegian Veritas highest class. The *Alma* has cellular double bottom for water ballast and afterpeak ballast tank, and will be provided with three steam winches, Emerson-Walker patent steam anchor windlass, Fisher's patent steam-steering gear, Bower's patent rapid-closing apparatus for stop valve (worked from bridge as well as engine-room), Bower's patent protection box for propeller shaft and donkey boiler; triple engines by the Laxevaags Engineering and Shipbuilding Co.—cylinders 15¾ in., 25½ in., 42 in., and stroke 30 in.; the boiler 13 ft. 6 in. diameter, 10 ft. 6 in. long for a working pressure of 160 lbs.

TRIAL TRIPS.

Newton Hall.—On September 20th the s.s. *Newton Hall* left the Wear for her official trial trip, the machinery working most satisfactorily in every way. She has been built to the order of Messrs. C. G. Dunn & Co., of Liverpool, by Messrs. J. L. Thompson & Sons, North Sands, Sunderland, and engined by the North-Eastern Marine Engineering Co., Limited, at their Northumberland Engine Works, Wallsend-on-Tyne (of which we gave particulars in our August issue, page 235). There was a large company present at the trial trip, including Mr. Dunn, representing the owners; Mr. Armstrong, representing the shipbuilders; Mr. Daglish, representing the engine-builders; Mr. Atkinson, of Messrs. Irwin, Atkinson & Young, Liverpool, under whose superintendence the machinery has been constructed; and Captain Kilvert, the owners' marine superintendent, who has personally supervised it. After the trial trip the vessel sailed for Galveston, U.S.A.

Manchester Corporation.—On September 26th the large steel screw cattle and cargo steamer *Manchester Corporation* proceeded on her trial trip. The vessel has been built to the order of the Manchester Liners, Limited, by Messrs. Furness, Withy & Co., West Hartlepool (of which we gave full particulars in our July issue, page 172). The trial trip was most satisfactory. The owners were represented by Mr R. B. Stoker and Mr. Greenip, the shipbuilders by Mr. H. Withy and Mr. G. W. Sivewright, and the engine-builders by Mr. T. Westgarth. After the trial trip the vessel proceeded to the Tyne for bunkers.

Rokeby.—On September 26th the new steamer *Rokeby* built by Messrs. Ropner and Son, of Stockton-on-Tees, to the order of Messrs. George Pyman & Co., of West Hartlepool (for further particulars see September issue, page 284), made her official trial trip in the Tees Bay, which proved satisfactory in every respect, and, after the adjustment of the compasses, the vessel proceeded on her voyage to the United States. The vessel has been built under the inspection of Mr. Cromer, the owners' superintendent surveyor, who was present at the trial trip, together with Mr. Smyth, representing the owners, whilst the builders were represented by Mr. L. Ropner

Shieldrake.—On Wednesday, September 27th, the s.s. *Shieldrake*, which has been constructed by Messrs. Wigham-Richardson & Co., Limited, for the Cork Steamship Co., Limited (for further particulars see October issue, page 326), went for a very successful trial trip off the Coast, the engines giving the greatest satisfaction. Immediately after the trial trip the vessel sailed for Antwerp under the command of Captain Dunn. The owners were represented on the trial trip by Captain Hore, of Liverpool, their marine superintendent, and by Mr. J. A. Flockhart, of Liverpool, their superintendent engineer.

Empress.—On September 29th the stern-wheel steamer *Empress*, built by Messrs. Ritchie, Graham & Milne, Whiteinch, for the African Lakes Corporation, Limited, had her trial trip. The vessel proceeded from Paisley (where she was engined by Messrs. Campbell & Calderwood) to Bowling, when she was tried on the measured mile, and afterwards to Prince's Dock, Glasgow, where her machinery will be landed, and the floatable sections taken apart and shipped by the corporation's specially chartered steamer engaged for the transport direct to East Africa. The results of the trial were very satisfactory. The vessel is fitted with the latest improvements in her type. Her dimensions are 105 ft. by 24 ft. beam, and she is provided with very comfortable accommodation for about 20 passengers. A similer steamer—the *Duchess*—but of smaller dimensions, is, at present being completed by Messrs. Ritchie Graham & Milne for the same owners. Both steamers are for navigation on the rivers Zambesi and Shiré, East Africa, and will bring up to seven the number of similar vessels on that section of the corporation's service to the lakes district of Central Africa.

Finanzminister Witte.-On September 29th the steamer *Finanz minister Witte*, built by Messrs. Robert Duncan & Co., Limited, Port-Glasgow (of which we gave particulars in our September issue, page 285), went down the Clyde on her official trial trip. The vessel was fully loaded and ready for sea, and none but the representatives of the builders, engineers, and owners were on board. The results of the trials of speed and coal consumption were satisfactory, and exceeded the guarantees given by the builders. After a series of trials had been run, the vessel left for Libau, Russia, where she is owned by the Rossija Steamship Co., and may be said to be the pioneer of steam shipping in that rising Russian port on the Baltic, as this is the first steamship registered and owned in Libau, and has been named after the present Minister of Finance to the Imperial Russian Government.

Olanda.—On September 30th the handsome steel screw steamer *Olanda*, built by Messrs. W. Gray & Co., Limited, for the Scheepvaart & Steenkolen Maatschappij, of Rotterdam (for further particulars see September issue, page 284), was taken for her trial trip. The vessel averaged nine knots, under very unfavourable weather conditions, the performance of ship and machinery being quite satisfactory. She afterwards proceeded to the Tyne to load.

Itzehoe.—On October 2nd the s.s. *Itzehoe*, built by the Flensburg Shipbuilding Co. to the order of the Deutsch Australische Dampfschiffs Gesellschaft (of which we gave particulars in our October issue, page 332), put out to sea for her official trial trip, during which the vessel averaged a speed of 13 knots, the owners having expressed themselves as perfectly satisfied both with the ship and the machinery. After the trial the vessel proceeded to Hamburg.

Glenroy.—On October 3rd the fine steel screw steamer *Glenroy*, built by Messrs. W. Gray & Co., Limited, to the order of Messrs. Livingston, Conner & Co., of West Hartlepool (for further particulars see September issue, page 282), had her trial trip. The vessel carried a full cargo of coals, and averaged a speed of 10½ knots.

Hero.—On October 3rd the large new screw steamer *Hero*, built by Messrs. Osbourne, Graham & Co., Hylton, and owned by Messrs. Brusgaard, Kjosterud & Co., of Drammen, Norway (of which we gave particulars in our September issue, page 283), left the Wear for her trial trip, which was in every way satisfactory, a mean speed of 11¾ knots being easily obtained.

Darleydale.—On October 7th the s.s. *Darleydale*, a fine large steel screw steamer, built by Messrs. W. Gray & Co., Limited, for the Dale Steamship Co., Limited (Messrs. Lucas & Co., of Bristol, managers) (for further particulars see September issue, page 283), had her maiden voyage to the Tyne, where she takes in her first cargo. Everything in the engine-room gave the utmost satisfaction, and the vessel averaged a speed of 11 knots.

Kelvingrove.—On October 7th the steamer *Kelvingrove*, which has been built by Messrs. Archibald McMillan & Son, Limited, Dumbarton, for the Glasgow Steam Shipping Co., Limited, had a very successful trial of her machinery. The *Kelvingrove*, which has been built to Lloyd's highest class, has a carrying capacity of 5,000 tons. She has been specially designed for the River Plate trade, and has a complete shade deck from end to end, above which is placed accommodation for the captain, officers, and engineers, which is of a more extensive and comfortable description than is usual in steamers of this class; the crew are berthed under the poop, and the cattlemen forward. The vessel is fitted in the most modern style for carrying cattle, and has electric light throughout and every convenience for the expeditious and safe working of ship and cargo. The engines have been constructed by Messrs. David Rowan & Co., and are of large power, so as to ensure a high speed for a vessel of this class. They are of the triple-expansion type, and the boilers, which are of large capacity, are fitted with Howden's forced draught. As the vessel is to be employed largely in the cattle trade, a very complete condensing plant has been fitted, capable of producing 40 tons of fresh water per day. The evaporators are of Morrison type, and the fresh water condensers are by Kircaldy & Co. Mechanical ventilation is provided in all ventilators by electric fans. The whole arrangements have been under the guidance and control of Mr. George McFarlane, of Glasgow. The steamer will be commanded by Captain E. H. O'Neal, the senior captain in the company's service. At the trial trip there was a large company of the friends of builders and owners, and, as it was a lovely day, the sail on the firth was much enjoyed. At the luncheon Mr. McMillan proposed success to the new steamer, which was enthusiastically pledged and responded to by Mr. J. Albert Black, of Messrs. John Black & Co., the managing owners. Immediately after the trial the vessel proceeded to Liverpool to load, under charter for Messrs. R. P. Houston & Co.

Stirling Castle.—On October 10th the Galloway Saloon Steam Packet Co.'s new steamer, *Stirling Castle*, launched on October 7th from the shipbuilding and engineering works of Messrs. John Scott & Co., Kinghorn, went on her official trial trip, when everything worked most satisfactorily, and the guaranteed speed of 15 knots was easily maintained. There, after turning trials were undergone with engines disconnected and one engine full speed ahead, and the other full speed astern, when it was found that the vessel could turn in her own length. There was a large company on board, including Mr. M. P. Galloway, of the Galloway Steam Packet Co.; Mr. S. Crawford, of John Scott & Co., the builders; Messrs. J. B. & R. S. Crawford, of John Scott & Co.; Mr. Harris, B.O.T.; Mr. Young, of the London and Edinburgh Steamship Co.; Mr. Welsh, superintendent engineer for the Furness Railway Co.; Mr. Weir, engineer manager to John Scott & Co., and others.

Nedenes.—On October 10th the steamer *Nedenes* (of which we gave full particulars in our Launch columns, October issue, page 327) left the shipbuilding yard of Messrs. Short Brothers for her trial trip, which proved in every way satisfactory. After adjusting compasses a series of runs was made over the measured mile, when a mean speed of 11 knots was attained. After the trial the vessel proceeded to Antwerp under the command of Captain Svenningsen.

Duke of Rothesay.—On October 11th the trial trip of the *Duke of Rothesay*, the latest addition to the Duke Line of steamers plying between Glasgow and Dublin, took place on the Clyde, between the Cloch and the Cumbraes Lights, a distance of 13½ miles, which was traversed three times. The trial was in every way satisfactory. The *Duke of Rothesay*, built by the Caledon Shipbuiding and Engineering Co., Dundee, is much longer and more commodious than any of the other steamers of this line. Her dimensions are:—Length over all, 276 ft. b.p., 265 ft.; breadth, 35 ft.; depth, 23 ft. 9 in., with a gross tonnage of 1,250. Accommodation is provided for 110 first-class passengers, 900 steerage, and 27 of a crew. The engines are of the triple-expansion type, having cylinders of 75 in., 47 in. and 28 in., with 45-in. stroke, and there are two double-ended boilers 13 and 10 ft. diameter by 20 ft. long, with a working pressure of 180 lb. per square inch.

Urlana.—On October 11th the steamer *Urlana*, built by Messrs A. & J. Inglis for the British India Steam Navigation Co., underwent her official trial over the measured mile at Skelmorlie. The *Urlana*, which has been constructed for the company's Eastern cargo trade, is 410 ft. between perpendiculars, 50 ft. 6 in beam, and 32 ft. deep, with a cargo capacity of about 8,000 tons. The machinery, constructed by the builders, is of the triple-expansion type, having cylinders 26¼ in., 42 in., and 66½ in. diameter, and 4 ft. 3 in. stroke, and is fitted with Howden's system of forced draught. The trial passed off most successfully and to the entire satisfaction of Captain Hodgkinson and Messrs. Clark and Dobbie, the representatives of the company.

Tagus.—On October 14th the new steam-ship *Tagus*, built by Messrs. R. Napier & Sons, Limited, Govan, for the Royal Mail Steam Packet Co., London (of which we gave particulars in our August issue, page 236), had a very successful trial trip. The machinery consists of a set of triple-expansion engines having cylinders 37 in., 58 in., and 97 in. diameter, by 5 ft. 6 in. stroke, and capable of indicating 7,000 H.P., with six single-ended boilers for a working pressure of 180 lb., and furnished with the most recent improvements for efficiency and economy, including Howden's system of forced draught, Gwynne's centrifugal pumps, &c. The *Tagus* has a very symmetrical appearance, and is altogether a splendid specimen of naval architecture. A marked feature of the trial was the absence of any vibration.

Portugal.—On October 14th the fine steel screw mail and passenger steamer *Portugal*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, for the Empreza Nacional de Navegaçao a Vapor, of Lisbon, was taken out to sea for her official trials under the command of Captain Cura. She is built to Lloyd's highest class, spar deck rule, her principal dimensions being: 377 ft. by 45 ft. 6 in. by 29 ft. 9 in., and has a deadweight carrying capacity of over 5,000 tons. The upper decks are of steel sheathed with teak. She is fitted with very first-class accommodation for passenger trade between Lisbon and the West Coast of Africa, having large saloon on the upper deck aft to accommodate 80 passengers, the walls of which are covered with decorated marble panels and elegant cabinet work in walnut, and upholstered in green Morocco leather; having piano at one end and sideboard at the other, the floor being laid in polished parquet of elegant design. The entrance lobby is of the same description and abaft of this is an elegant saloon for the accommodation of ladies, in light coloured, polished woodwork and tapestry panels. The sleeping accommodation for first-class passengers is provided in the 'tween decks under the saloon in large staterooms, having two berths and a good sofa only, all the joiner work of these cabins being in polished hardwood of very elegant description. Handsome bathrooms are provided having marble baths with hot and cold water service. The floors are laid in encaustic tiles and the lavatory accommodation is very complete and of the latest style. Large mail and baggage rooms are situated in the middle part of the ship, the cabins being kept to the outside for light and air. Ventilation is also provided for by air-channels from every one of the rooms leading to an electric exhaust fan in the engine room. Electric light is also distributed throughout the ship, and there are extensive refrigeration-chambers for the preservation of provisions. Above the saloon aft there is also a large airy smoking-saloon decorated in coloured marble, and with a highly ornamental dome glazed with decorated glass, the principal feature of which are the emblazoned arms of the Empreza

Nacional Co. Accommodation for 40 second-class passengers, with saloon from side to side of the ship, is in the 'tween decks amidships, and the 'tween decks forward are fitted for the accommodation of 250 emigrants or third-class passengers, having separate cabins to be used as a hospital in case of need. A very complete galley, with steam cooking apparatus with ovens, is provided amidships; and also for native passengers a galley with three large steam boilers in the forecastle. The arrangements on deck are very complete for working cargo by means of eight steam winches, and a powerful derrick for lifting 20 tons weight. Numerous ventilators to the holds and 'tween decks are also a prominent feature on deck, and on top of the bridge amidships are steel lifeboats, and a large-sized steam launch is carried in the davits. The engines, by Messrs. Thomas Richardson & Sons, Limited, of Hartlepool, are of about 3,000 I.H.P., and will give a speed of over 12 knots at sea. The engines are of the latest design, and fitted with Weir's feed-pumps, centrifugal circulating pumps, pulsators, feed-heater and evaporator; also bronze blades for the propeller, and all their latest improvements. A large party of friends were on board during the trial trip, and the vessel made her runs over the measured mile, quickly obtaining a speed of about 14 knots. The vessel has been under the supervision of Mr. T. C. Laws, of Liverpool, representative of the Empreza Nacional of Lisbon in this country. The engines have been surveyed by Mr. Edwards. It has been arranged by her owners and builders to admit the public on Sunday to inspect this fine vessel at a small charge, for the benefit of the North Riding Infirmary. After taking in necessary coal she will proceed to Lisbon on her way to the West Coast of Africa.

Saxoline.—On October 19th this vessel, built to the order of Messrs. Lane & Macandrew, of London, on behalf of Messrs. Desmarais, Freres of Paris (of which we gave particulars in our October issue, page 327), was taken for trial from the builders' yard, Messrs. Sir W. G. Armstrong, Whitworth & Co., Newcastle. On the trial the speed was calculated at almost 11 knots. After the trial the vessel returned to the Tyne to bunker before proceeding on her maiden voyage.

Bylands.—On October 21st the new steamer *Bylands*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. Joseph F. Wilson & Co., of West Hartlepool (of which we gave particulars in our October issue, page 328), made her official trial trip in the Tees Bay, which proved satisfactory in every respect, and she sustained an average of 11 knots. After the adjustment of compasses, the vessel proceeded on her way to Cardiff, to load for Bombay. The vessel has been built under the inspection of Mr. Maddison, the owners' superintendent surveyor. He was present at the trial trip, and expressed great satisfaction with the vessel.

Sheppy Allison.—On October 21st this vessel had her maiden voyage, proceeding to Sunderland, where she loads for Marseilles. She is a fine steel screw steamer, built by Messrs. William Gray & Co., Limited, to the order of Messrs. J. S. Allison & Co., of West Hartlepool (of which we gave particulars in our October issue, page 328). Amongst those who went round with the ship were Mr. Sydney Hogg, managing owner; Captain T. Morris, who has inspected the vessel during construction; Mr. James C. Clarke, consulting engineer, who has superintended the building of the engines; Captain Murrell and Mr. McGlashan, from the shipyard; and Mr. W. C. Borrowman, manager of the engine works. The trial was a very satisfactory one, an average speed of 11 knots being recorded.

Eclipse.—On October 23rd the trial trip of the steam trawler *Eclipse* took place, and proved highly satisfactory, a speed of 10½ knots being attained. The vessel was recently launched by the Irvine Shipbuilding and Engineering Co., Limited, for the Peterhead Trawling Co., Limited, Peterhead, and is fitted with all the latest appliances for fishing in the North Sea. The dimensions of the vessel are: 117 ft. between perpendiculars by 21 ft. by 11 ft. 9 in. moulded, and the engines, supplied by W. V. V. Lidgerwood, Coatbridge, are triple-expansion, having cylinders 12 in., 19½ in., and 32 in. by 22 in. stroke. The builders have three other similar vessels on hand for the same firm.

Atlantian.—Lately the large steel twin-screw steamer *Atlantian*, built to the order of the West Indiaand Pacific Steamship Co., Limited, of Liverpool, by Messrs. Sir W. G. Armstrong, Whitworth & Co. (of which we gave particulars in our August issue, page 233) left the Tyne for a trial trip. The vessel and machinery, which worked with the greatest regularity and smoothness, gave entire satisfaction to all those on board. After the compasses had been adjusted a trial of some hours' duration was made, and a mean speed of over 13 knots was obtained.

Trevessa.—Lately the new steamship *Trevessa*, a steel screw steamer, built by Messrs. John Readhead & Sons, South Shields (of which we gave particulars in our October issue, page 326), went on her trial trip off the Tyne. The vessel having had her compasses adjusted, made a series of successful runs to sea, averaging a speed of 11 knots. The behaviour of the *Trevessa* was all that could be desired, her performances giving every satisfaction to those concerned. This steamer is the thirty-fifth built by Messrs. Readhead for the firm of Messrs. E. Hain & Son, St. Ives.

Nicolai Pallibin.—Lately the *Nicolai Pallibin*, a powerful self-propelling bucket-ladder dredger, recently built by Messrs. Fleming & Ferguson, Limited, Paisley, completed a series of dredging and speed trials. This dredger has been built to the order of the Imperial Russian Government, and is intended for carrying out deepening operations at the port of Kertsh, in the sea of Azof. The dimensions of the vessel are 157 ft. by 33 ft. by 12 ft. It is constructed with single ladder and chain of buckets working through centre of hull. Each bucket has a capacity of 22 cubic feet, and the dredger is capable of raising 1,000 tons of material per hour from a depth of 33 ft. The trials were superintended on behalf of the Russian Government, by Colonel Petroff, Chief Commissioner, and were in all respects entirely satisfactory, and the dredger thereafter started under her own steam.

Reviews.

The Arithmetic of Electrical Measurements. By W. R. P. Hobs. London: Thomas Murby & Co.

The author of the present volume (which is one of Murby's Science Series), from his position as headmaster of the Naval Torpedo School at Portsmouth, brings the best possible qualifications to his task. It is intended to be a clear and a concise application of Ohm's law such as young students can appreciate and grasp. How far he has fulfilled his aim is shown by the appreciation with which his book has been received. Already six editions have been absorbed, and this fact is in itself enough. The treatment of the subject is thorough and mathematically exact. The student is taught to deal with something more than tendencies. He learns how to appreciate the force and extent of the movements and currents whose nature he is considering. In each chapter of the work, certain brief and lucidly expressed rules are laid down, then examples illustrative of their working are set out, and finally a large number of problems based upon these examples are afforded for practice and further illustration. To these the answers are disclosed, so that the student is enabled to ascertain whether or not he has correctly grasped the theory, and properly worked out the mechanical part of the task. The little book is a most useful addition to the student's library.

How to enter the Royal Navy. By Ernest J. Felix. London: Simpkin, Marshall, Hamilton, Kent & Co. No date. Price 1s.

The subject of the little book is a very good one, and it aims at filling a niche which ought to have long ago been filled. The naval service is one which suits the temperament of young Englishmen. It is a profession of the highest honour, yet one to which the sons of relatively poor people may aspire. Parents who send their sons to serve their country at sea may know that they secure to their offspring healthy conditions of life and a certain means of livelihood. At the same time they are fulfilling a patriotic duty of the most important character. It is constantly brought to one's notice that if the way to get boys into the various branches of the Navy were better understood there would be no possibility of difficulty in obtaining all the officers (and men, too) that could conceivably be required.

The little book before us gives details of the cost of sending boys into the various branches, including the supply and accounting departments, and affords information as to the requirements exacted from candidates and as to the prospects which lie before them if successful in their examinations.

Details as to the various examinations are naturally dwelt upon. This is only to be expected when we remember that the author is intimately connected with a tutorial establishment. Copies of recent examination papers are given, and solutions to these, worked out by various officials of the establishment in question, are furnished in the appendix. It is thus possible, without much trouble, to ascertain the kind of instruction which intending candidates for the Royal Navy will need, and a standard is, at the same time, set up whereby the probabilities of success can be gauged.

Special attention is rightly directed to a memorandum which sets out some of the physical defects which will for ever debar a boy from thinking of entering the Queen's service afloat. Careful study of this is properly insisted upon, because it may save parents and boys from waste both of time and money and the following bitter disappointment

---

Feilden's Magazine for September and October, 1899, issues. London: The Feilden Magazine Co.

It is a poor compliment to British industrial art in general that everyone who has picked up the copy of this magazine, which has been lying for a couple of days on the reviewer's table, should have remarked, "So there's another new American magazine out," and not been convinced that it was "quite English, you know," till they opened its pages. The get-up both in illustration and paper is quite up to the best American standard, though the printing might with advantage be somewhat improved. For example, on page 218, September issue, eight and nine lines from the bottom there are two instances of broken type, and at the beginning of the fourth line on page 207 an "f" has fallen out. These things are trifling indeed. We only mention them to show that our criticism is discerning, and that, when we speak of other parts of the work as really excellent, we mean that they are as near perfection as can be reached in the present year of grace and under ordinary commercial conditions.

There are many articles in the September issue which deal with subjects rather foreign to our readers. But they will find them none the less instructive and interesting on that account. Amongst these we may notice a profusely illustrated article on the Great Central Railway. This runs through from the initial issue of the magazine. There is a description of the Colt Automatic Machine Gun, which it seems should be read by all intelligent students, for the gun in question seems likely to play a great part in future operations. Under the title "An Innovation in the Glass Industry" we read of a mechanical device for blowing glass. Professor Vivian B. Lewis continues his account of "Acetylene Gas Generators" up to date. Mr. P. R. Bjorling discusses piston and ram pumps. Sir William Roberts Austen speaks of the fractures which are made in projectiles in armour plates, and Mr. Scott-King writes on the "Construction and equipment of an up-to-date Engineering Works." This last article should be read by engineers and boilermakers with great care. It will certainly repay perusal. The same may be said of Mr. Tom Mann's contribution on engineering in Britain and America. Manufacturers who read may form their own opinion of the weight of his criticism of their methods in dealing with their workpeople. We will content ourselves with disputing his proposition that "neither Britain nor any other country can have or ought to have a monopoly of the world's trade." Without construing the word "monoply" in its most absolute sense, we are content to say that Britain did have as near a monopoly as was attainable a quarter of a century ago. She worked for it and she got it, There was no sign then that this was unfair to other nations. They had their agricultural and their other industries. Britain laid herself out entirely for commercial supremacy. She adopted free trade. She put her land out of cultivation. Surely there must be something wrong if after all this other nations, without making such sacrifices as we have made, are cutting seriously and deeply into our most cherished industries! Workpeople say the masters are to blame, masters blame the men. Strikes and lock-outs have had much to do with the falling off, no doubt. But the truth probably is that there are faults on both sides, and that too much prosperity has been bad for every one. If that be so, the re-action now coming will soon correct them—if the lesson come not too late.

The October issue contains, amongst other articles: "Governors: or, Control and Steadiness in Machinery," by Professor Robert H. Smith; "Modern Telephony," by A. R. Bennett, M.I.C.E.; "Machine Tools," by Ewart C. Amos, M.I.M.E.; and "A New System for Gas and Oil Engines."

The Shipowners' Technical Code Book. By Walter Phillips. London: Whitehead, Morris & Co., 1899.

The design of this work is to supply a code word, as far as possible, for every portion of the ship, be she steamer or sailing vessel, and for every part of her machinery, giving, where the parts for the different sides of the ship are different, alternative words which distinguish that required for the port side from that which goes to starboard. There are code words for dates, numbers, and latitude and longitude, and for a large number of matters and sentences connected with electricity. These latter, owing to the growing importance of electrical installations aboard ship, should be very useful. Special attention is also devoted to the section which comprises miscellaneous sentences. The code is designed in short, for communications between the shipmaster and the owner, though it is also likely to be largely availed of by underwriters, surveyors, and salvage people. The author seems to have made an exhaustive list of the things which are likely to need cabling, and we do not doubt that the book will prove very useful to the classes for whose benefit it has been compiled.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from June 8th to October 12th, 1899.

11519	P M. Justice. (The Societe Anonyme De Temple, France.) Water-tube steam generators.
11528	T. R. R. Ashton. Locking nuts.
11529	G. Hullstrung. Lubricator.
11533	A. J. Boult. (L. E. de Manresa, Spain.) Propulsion of vessels.
11548	F. Edwards. Pumps.
11569	J. Chambers and J. Colley. Fittings of ships' gaffs.
11570	W. H. Fitzgerald. Boats.
11572	D. Tulloch. Rotary engines.
11595	W. Hudson. (L. Young, Italy.) Navigable rafts.
11597	A. E. Hiles. Governing speed of marine engines.
11655	J. McLelland and W. Waddell. Ship ladder.
11689	A. Dockir. Steam generators.
11709	S. E. Alley. Steam engines.
11724	B. Frohlich. Boiler furnaces.
11730	W. C. Haynes. Launching ships' boats.
11738	The Cape Asbestos Co., Limited, and H. Kuper. Fibrous covering for the ends of cylinders.
11739	T. Litwiller. Steam engines.
11766	W. P. Thompson. (The Foster Engineering Co., United States.) Valves.
11806	J. C. W. Lloyd. Feed-water regulators.
11810	J. N. Brown and A. G. Robson. Disengaging apparatus for ships' boats.
11817	C. H. Brigg. Steam engine governors.
11833	J. M. Croom. Hand and steam-steering gear.
11859	F. W. Barthels. Uniting flanges to tubes.
11863	W. C. Brett. Valves.
11890	L. R. Carrington. Propellers for vessels.
11915	A. Webster. Raising and Lowering cargo in ships.
11988	B. R. Herman. Safety valves for boilers.
12007	W. E. Moss. Derrick gear for ships.
12034	H. Hoffmann. Packing pistons and valves.
12038	B. Heymann. Ships' ladders.
12043	T. V. Trew. Ships' rudders.
12060	H. Wood and A. S. Williams. Cattle pens for use on ships.
12067	J. McIver. Lubricating apparatus for steam cylinders.
12184	S. E. Alley and D. Matthieson. Evaporating feed-water.
12186	T. Christie. Ships' berths.
12188	R. Welford. Furnaces for steam generators.
12216	Z. Wirt. Rotary engines.
12239	C. Gouzin and P. Bleys. Engine regulator.
12244	F. W. Lanchester. Motive-power engines.
12258	D. G. Martens. Construction of ships.
12259	F. W. Golby. (J. Schutte, Germany.) Steam boilers.
12327	L. E. Cowey. Valve gear for engines.
12343	The Petersen Water-tube Boiler Co., Limited, and J. B. Furneaux. Water-tube boilers.
12357	A. G. New. Internal combustion engines.

12401 Z. Keough. Friction clutches.
12415 H H. Lake. (A. J. B. Body, Victoria.) Submarine boats
12418 J. M. Gilbert. Shipping crates.
12433 J. W. Mackenzie. (R. Kron, Germany.) Operating the valves of steam engines.
12449 P. Cogan. Internal combustion engines.
12460 T. Cossar. Preventing corrosion in steam boilers.
12462 G. J. F. Black. Centrifugal pumps.
12480 W. Holden. Collision bow for steamships.
12483 H. Jessop. Raising sunken vessels.
12494 J. Hamilton. Hoisting out ships' boats.
12496 J. M. Chapelle. Pistons for steam engines.
12500 W. Buckley. Valves.
12502 S. Penney & J. D. Potter. Tide indicator.
12503 H. H. Lake. (Richardson Lock Nut Co., United States.) Lock nut.
12509 A. Kramer. Steam engine valve gear.
12534 P. Davies & A. Ross. Steam generators.
12584 H. J. C. & J. A. Pattison. Water-tube steam generators.
12621 D. Mc Lachlan. Steering gear for boats.
12634 D. Mackay. Anti-fouling process for ships' bottoms.
12658 J. C Dobbie. Navigational sounding apparatus.
12661 T. & F. Oldham. Rings for metallic pistons.
12669 F. G. Diaz. Rotative propulsion of vessels.
12676 W. Rowbotham. Lighting of lifebuoys.
12769 N. A. Krag & O. Arnesen. Measuring the distance from a ship to the shore.
12838 H. Thomas. Rotary engines.
12847 G. F. G. des Nignes & W. A. Cloud. Steam generators.
12849 F. S. Pett. Boat-lowering gear.
12970 E. Efran. Furnaces for steam boilers.
13001 A. J. Boult. (La Société Prentout Leblond and Boniface and Frederic Gagu, France.) Sails of vessels.
13003 W. B. Fisher. Screw propellers for vessels.
13013 J. Huevkovsky. Increasing speed of ships.
13023 W. L. Wise. (G. W. Youmans, United States.) Pump pistons.
13026 P. M. Justice. (The "Long-arm" System Co., United States.) Opening bulkhead doors.
13033 A. T. Otto. Marine propulsion.
13046 J. B. Habershon. Water gauges for steam boilers.
13057 L. L. Grouse. Protection of vessels and harbours.
13069 A. J. Boult. (F. A. Tienpont, Holland.) Engine governors.
13087 H. H. Lake. (L. Wehner, United States.) Regulating devices for vacuum pumps.
13112 J. P. Davies. Water-tube boilers.
13134 F. R. Putz. Lubricators.
13192 W. H. Wise. Winches.
13218 W. Houghton. Doors for bulkheads, &c.
13239 E. Davies & J. Jones. Cranes.
13283 W. H. Wise. Winches.
13292 W. T. Wray. Rotary valves for steam engines.
13326 K. Park. Steam generators.
13364 P. J. Wilson. Lock-nuts.
13381 W. L. Randall. Portable screw propeller.
13405 H. & S. H. Hawkins. Motive power for hydraulic engines.
13448 D. B. Morison. Forgings.
13481 A. Dodgson. Feed-water filters.
13484 P. B. Wilson. Valve for steam engines.
13509 J. G W. Aldridge. Cranes.
13529 W. E. Crisp. Propelling machinery for boats.
13553 T. Wilson. Steam engines.
13562 J. Y. Johnson. (H. S. Carley, United States.) Lifeboats.
13569 J. C. Howell, T. Humpage & H. I. Jacques. Winches.
13586 N. Joseph. Shipbuilding.
13631 W. McQuoid. Lowering ships' boats.
13633 E. C. Mills. Feed-water filters.
13644 W. Fox & H. Laverack. Cleaning boiler tubes.
13659 J. McKay. Propellers.
13759 J. Bell Clinometers for ships.
13810 A. J. Boult. (P. Manchin & L. Boudreaux, France.) Ships.
13814 O. Holtken. Preventing ships flooding.
13815 W. R. Emerson. Steam vacuum pumps.
13822 E. J. Deegan. Ships' logs.
13841 R. Haddan. (I. Lehman, United States.) Steering apparatus for boats.
13855 W. Pilkington. Sight rule indicator.
13858 A. E. Line & J. Abraham. Steam engines.
13869 J. Adair. Controlling the speed of steam engines.
13870 E. Williams. Stop valves for steam.
13931 J. K. Tullis. Propelling ships.
13943 W. A. Mitchell. Raising sunken vessels.
13976 J. Donaldson. Stern-wheel steamers.
13982 A. Friedmann. Pumps.
13989 C. Lamprecht. Asbestos covering for boilers.
13992 A. E. Luttrell. Rotary pump.
14002 J. Trolley. Using forces produced by pistons.
14013 A. Carne. Sextant.
14017 A. E. Ballan & D. B. Morison. Shipment of coal.
14020 J. Mair. Engine.
14024 R. W. Monahan & H. Barsdorf. Safety appliance for derrick cranes.
14042 A. J. Ickringill. Fans or air propellers.
14068 R. W. James (G. D. Coleman, United States). Anti-fouling coating for wooden submerged structures.
14069 R. W. James (G. D. Coleman, United States). Anti-fouling coating for metallic submerged structures.
14077 E. Petersen. Marine boilers with induced draught.
14081 P. W. Davies. Actuating pistons in cylinders.
14089 J. Klein. Condensers for steam engines.
14097 H. C. Bull & A. Watling. Extraction of gold from sea water.
14108 W. Ambler. Water-tube boilers.
14119 F. L. Lane & W. Rainforth. Hydraulic valves.
14144 A. Petit. Boilers.
14148 F. Staniland. Conveying coal to ships.
14193 W. H. Vernon. Fuel economisers for heating boiler-feed water.
14203 G. U. Merrill. Lubricators.
14211 A. J. Boult (H. T. F. Grossmann, Germany). Collapsible tubes.
14219 H. Theis. Shot-proof armour.
14263 B. S. Lawson. Bearings.
14294 H. Ryan. Shields for naval purposes.
14295 W. R. Lake (Schaffer & Budenberg, Germany). Lubricating apparatus.
14335 P. Bredt, jun. Feed-water heater for boilers.
14337 M. Michon. Rotary engine.
14354 W. A. McCurd. Propelling ships.
14358 H. Brewer. Protecting shafts from corrosion.
14362 J. Davidson. Steam engines.
14387 L. Gerard. Apparatus for towing ships.
14407 T. H. H. Bodde. Preventing collisions at sea.
14414 H. C. Bull, J. Ramage, & S. H. Evans. Engines.
14442 T. Mutamer, A. Jordan and J. G. H. Browne. Steam Generators.
14481 F. R. Simms. Cooling engine cylinders.
14517 G. E. Rennie. Funnels.
14526 A. Heel and F. Dieckmann. Reversing hydraulic propellers.
14538 W. R. Barkworth. Trawl boards for fishing purposes.
14582 J. Reid. High-pressure piston.
14600 C. E. and R. McAllister and W. T. Harris. Boilers.
14638 A. T. Dawson and J. Horne. Winches.
14640 S. O. Cowper-Coles. Preparing steel.
14641 C. G. de la Paz. Indicating the flooding of watertight compartments.
14663 J. J. Royle. Sight-feed lubricators.
14684 F. S. Snowdon and W. J. Orr. Increasing the efficiency of screw propellers.
14688 F. W. Jurgschat. Life belts.
14692 J. T. Armstrong and A. Orling. Controlling torpedoes.
14728 J. Gill. Water-level indicator for gauges.
14742 T. and W. G. Pratt. Fullway steam trap.
14788 W. T. Parrott. Buoy and anchor lights.
14839 G. Durr. Tubular steam generators.
14840 G. Durr. Multitubular boiler.
14841 J R. Mackay. Flues of steam generators.
14854 I. L. Kempson. Seamless steel tubes.
14862 W. Jackson. Cleansing steam generators.
14875 A. F. Cole. Lubricators.
14886 C. Janczarski. Propulsion of ships' boats.
14887 F. W. Grew and E. Tellefsen. Buoying sunken vessels.
14890 M. Guttner. Centrifugal apparatus.
14920 S. Schur. Life-saving apparatus for boats.
14924 R. Carver. Preventing propellers racing.
14926 S. A. Smith. Rapidly reducing ships' speed.

14942	G. D. Macdougald. Condenser for steam engines.
14952	C. Strutt and O. A. Hockey. Apparatus for registering the level of water in boilers.
14962	M. Williams. Wrenches.
14967	A. Debry and A. Philibert. Cooling cylinders.
14974	O. Imray. (E. B. Brown, United States.) Lubricators.
15001	R. Wagner. Power engine governor.
15005	T. McKenna. (L. Lake, United States.) Distributing oil on the sea.
15009	W. M. Burnett. Boats' chocks.
15033	G. Cardosa. Screw propellers for ships.
15038	F. E. Musgrave. Multiple-cylinder engines.
15053	W. Heatley. Removal of fouling from ships' bottoms.
15059	D. Chapman. Life buoy waterproof.
15079	T. Hope. Paddle wheels.
15084	A. Radovanovic. Connections between piston-rods and crank shafts.
15089	G. Sellers. Valves.
15154	H. H. Lake. (H. S. Durand, R. McC. Beck and R. K. McLellan, United States.) Mechanism for propelling boats.
15177	J. H. S. Bradley. Autmobile fish torpedo.
15184	R. Knappik. Circulation of water in boilers.
15204	R. Wagner. Marine engine governor.
15206	C. G. Meissner and R. Bennetwitz. Hardening steel.
15222	C. Smith. Compasses.
15.30	F. Reddaway & Co., Limited, De C. C. T. Davies and T. Potter. Friction clutches.
15243	B. J. B. Mills. (W. De L. Walbridge, United States.) Boiler furnaces.
15262	A. G. Melhuish. Pistons of steam engines.
15319	A. T. Orr. Ships' ventilators.
15320	C. M. Shaw. Water-tube steam generators.
15322	J. A. Webster. Regulator of compass.
15366	A. Gough. Cowl.
15367	W. P. Thompson. (M. H. Rumpf, France.) Engines.
15375	F. Fouché, L. Savatier, C. de Lagabbe, and A. Bochet. Refrigerating cargo of ships.
15376	J. Stuart & J. H. Barton Prismatic binoculars.
15382	M. Hunter. Bulkhead for ships.
15387	J. McLay. Heat non-conducting coverings.
15394	H. Bea & P. Offenbroich. Life-saving belt.
15417	W. Luis. Boilers.
15442	R. Scott. Water-tube steam generators.
15455	R. G. Linn. Connecting rods.
15458	H. M. Robinson & A. E. Elliott. Boilers.
15465	J. W. Green. Pleasure boats and steamers.
15485	J. R. Wigham. Occulting apparatus for buoys.
15508	W. Reeves & The Reeves Patent Filters Co., Limited. Filters.
15509	W. Reeves & The Reeves Patent Filters Co., Limited. Filters.
15561	W. Andrews. Friction clutches.
15563	U. C. Dale & G. Overy. Gaff jaws of sailing vessels.
15597	E. Gathmann. Torpedoes.
15619	E. Ziegler. Combination screw-down valve.
15624	G. A. Nussbaum. Tube joints for steam generators.
15636	C. Cole. Otter boards used in trawling.
15642	R. Begas. Propelling boats.
15656	W. Hornsby, D. Roberts, & C. James, jun. Application of doors to engines.
15657	W. Hornsby, D. Roberts, & C. James, jun. Speed governors.
15658	W. Hornsby, D. Roberts, & C. James, jun. Steam engines.
5663	R. J. Isaacson. Governing devices for engines.
15695	J. Southall. Internal combustion engines.
15702	H. R. Mortell & A. Robb. Trawl nets.
15703	J. McIntosh & G. W. Metcalf. Boilers.
15710	H. K. Gilbert. Water gauges.
15715	G. H. Jones. Defence against torpedo attack.
15728	A. L. Lefebvre. Steam generators.
15733	G. P. B. Hoyt. High-speed engine.
15735	J. S. & J. B. White & A. Forster. Water-tube boilers.
15736	A. E. Farrow. Variable-speed gear.
15742	H. G. Tidemann & E. D. Meier. Boiler doors.
15769	J. W. Brown & T. Buckton. Feeding oil into engine cylinders.
15771	T. Buckton & J. W. Brown. Regulating speed of engines.
15772	E. L. Cooper. Seamless metallic tubes.
15791	A. Dodgson. Firing regulator for boilers.
15808	F. Krajoa. Life-saving belt.
15822	D. Orecchioni. Electric submarine signalling device.
15828	A. J. Boult. (F. A. Thoenes, Germany.) Packing rings.
15844	D. Carter and C. J. Smith. Rotary engines.
15849	R. S. Lloyd & S. Davies. Pumps.
15851	E. Kaselowsky. Torpedoes.
15854	D. B. Morison. Propeller shafts.
15855	R. P. Matthew & W. Henderson. Propellers for actuating ships.
15880	J. Christensen. Governing ships' rudders.
15893	P. Menz & M. Sponholz. Reducing valves.
15910	E. Rund. Internal combustion engines.
15917	R. E. Byle, H. A. Fillmore & R. H. Nicholson. Pneumatic packings for piston rods, &c.
15924	F. Good. Docks.
15931	J. M. Thomas. Rudders.
15970	H. J. Haddam. (A. R. Weisz, H. I. Stockwell, and F. G. Fullgraff, United States.) Means for propelling ships.
15989	G. F. W. Hope. Apparatus for dredging.
15995	S. Briggs. Tubes of refrigerators.
16007	A. Strong and W. S. Drysdale. Saving life on water.
16034	J. Broadfoot. Watertight doors for ships' bulkheads.
16075	L. M. G. Delaunay-Belleville. Feed-water heaters.
16086	C. Bonjour. Distributing mechanism of steam engines.
16098	S. Cowper-Coles. Rendering wood non-inflammable.
16113	G. W. Sutherland. Ships' hatches.
16124	F. W. Golby. (E. Brucksh, Germany.) Reversing gear.
16155	F. Watt. Feed-water regulators for steam boilers.
16188	W. Bingham. Controlling gear of valves.
16244	A. J. Dudgeon. (Société Anonyme J. Cockerill, Belgium.) Blowing engines.
16248	C. D. Abel. (The Gasmotoren Fabrik Deutz, Germany.) Pistons.
16249	F. Kupper & A. Vorreiter. Speed governor.
16289	W. Lees. Valve gear of steam engines.
16347	R. D. Bailey. Machine for circulating steam.
16365	H. & A. H. Ough. Building ships, &c.
16390	H. Holst. Propellers for ships and boats,
16415	W. Fairweather. (J. Morssink, Holland.) Ships' side lights.
16430	C. T. Holloway. Chairs for decks of ships.
16455	O. Comuzzi. Anti-fouling composition for ships' bottoms.
16480	F. Friedenthal. Indicating propeller pitch.
16503	J. Hewes. Promoting the safety of boats.
16517	E. G. Hoffmann. Ball-thrust shaft bearings.
16524	A. Fensom. Power propellers for barges.
16542	N. Weeda. Water gauges for steam boilers.
16550	J. C. Johnson. Welded iron and steel tubes.
16609	T. H. Massey. Friction gears or couplings.
16620	C. D. Doxford. Construction of ships.
16630	B. M. Whitlock. Cleaning cables of ships.
16655	R. J. Lichtenstein. Scraper for boiler tubes.
16659	A. L. Brun & L. Leclerc. Multitubular boilers.
16697	L. H. Drake. Bearings for continuous shafting.
16700	F. E. Musgrave. Compound steam engines.
16711	C. P. Smith. Glass water levels or gauges.
16726	J. Gordon. Recording speeds of ships.
16727	R. B. Daines. Dislodging barnacles from ships.
16742	J. E. Slack. Water-tube steam generators.
16784	T. P. Robson & A. Stuart. Cranes
16790	W. Marr. Apparatus for stowing boats.
16840	H. W. C. Cox & C. F. Leighton. Steering boats.
16892	C. Allenow. Rotary engines and pumps
16910	A. B. Brown. Steering machinery.
16938	H. Henning. Governing valves.
16967	B. A. W. Holtorp. Raising gear for boats.
16968	A. May. Steering apparatus for ships.
16975	E. Makin, jun. Steam cylinder cover.
16996	J. E. Weyman. Feed-water heaters.
17021	C. E. Ferreira, W. B. Roberts, & T. W. Gleason. Feed-water heaters.
17023	L. C. Lanphear. Feed-water heaters.
17040	J. Milton. Furnaces for steam boilers.
17042	G. R. Purdy. Fittings for trawl boards.
17068	J. Orr. "Automatic baler" for lifeboats.
17092	J. K. Macdonald. (The Singer Manufacturing Co., United States.) Lubricating cranks.
17142	G. S. Hooker. Varying the speed of driven shafts.

17178 F. H. Lloyd. Weldless steel and iron tubes.
17230 W. Cooke. Ventilators for ships.
17296 W. M. Walters. Appliances for steering ships.
17301 W. M. Walters. Raising sunken ships
17303 W. M. Walters. Appliances for propelling ships.
17319 The Steel Nut & J. Hampton, Limited, and S. Hampton. Cable grips.
17327 W. P. Thompson. (M. P. Hoy, United States.) Lifeboat.
17331 R. Wagner. Forced-draught furnaces.
17378 J. H. S. Bradley & P. Nisbet. Torpedo.
17399 J. B. Bell. Dredgers.
17404 H. Agar. Marine governor.
17448 J. MacE. Ross. Riveting apparatus.
17460 I. Crocker. Anchors.
17502 G. S. Strong. Construction of boilers.
17532 T. Wollstein. Metallic steam packing.
17555 D. Short. Bearer for steam boiler furnaces.
17566 P. B. Handley. Brackets for shaft bearings.
17601 A. Southwell. Cleaning the bottoms of vessels.
17614 J. Leadbetter, J. Leadbetter, jun., & E. R. Baker. Ships.
17616 J. J. Whittaker. Steam boiler furnaces.
17623 J. Vreugdenhill. Steering gear for ships.
17624 A. Moxa & A. Sivitz. Reversing engines.
17643 P. F. Llosas. Obtaining power from the tide.
17670 L. A. Smallwood. Seamless metallic tubes.
17684 J. Kay. Ballasting tanks for marine vessels.
17690 E. J. Duff & The United Alkali Co., Limited. Brine-evaporating apparatus.
17691 E. J. Duff & The United Alkali Co., Limited. Evaporating brine.
17769 J. L. Beathall. Making armour plates.
17811 G. E. & J. F. Stead. Steam boiler and pipe covering.
17850 W. Roadman & L. Byers. Piston packing.
17859 J. D. Davenport. Raising sunken vessels.
17889 A. Hebden. Navigating rule.
17907 W. E. Rogers. (J. R. Macaulay, Hawaii Islands.) Paddles.
17908 E. B. Heayns. A longitudinal propeller.
17932 J. M. Fields. Correcting compass errors.
17933 F. Cundall. Rowlocks.
17948 R. Schulz. Small tube water-tube boilers.
17951 F. Ward. Jackets for shipwrecked persons.
17958 C. A. U. Pepin. Life-saving raft.
18009 C. J. Blackburn. Lubrication of paddle-wheels.
18042 A. C. Greene. Deck chairs.
18065 T. H. Massey. Hammers worked by steam.
18079 W., J., & E. Rockhill. Tubular boilers.
18081 B. M. Tregaskes. Stopping ships.
18085 G. Berghausen. Indicator for steam engines.
18104 G. H. Merritt. Oiling piston-rods on engines.
18123 G. Stumpf. Shaft governors.
18137 J. A. Duthie. Herring fishing boats.
18200 D. Kennedy. Telegraph apparatus for ships.
18213 W. R. Lake. (T. S. Miller, United States.) Shipment of coal.
18218 J. R. R. Hölscher. Water gauge glasses.
18245 G. Bristow. Appliance for transporting timber.
18249 R. Armstrong. Lubricating apparatus.
18252 H. Smith, H. Smith, jun., & O. Smith. Launching ships.
18291 J. H. Bell & W. Rockliffe. Ships' combings.
18306 H. B. & J. S. Watson & E. C. Billetop. Boiler tubes.
18313 C. T. Crowden. Multiple-expansion engines.
18320 F. S. Cormier. Steering gear for ships.
18331 W. J. S. Grawitz. Friction clutches.
18348 J. Hallett & G. Halliday. Water-tube steam boilers.
18351 C. F. Schulz. Propulsion of vessels.
18354 J. Rotherham. Lubricators.
18410 S. von Kvassay. Fin-like propeller for ships.
18417 F. W. Hornish & A. C. Clark. Boiler cleaner.
18419 F. C. Höge. Non-conducting covering.
18435 W. Spence & J. Nolan. Pistons.
18463 H. Lees. Steering and propelling boats.
18480 J. M. Hurd. Water-tube steam generators.
18494 L. Becker. Life-saving boat.
18528 E. R. Oldham. Fire bridges for boiler flues.
18529 W. Potts. Light feed lubricators.
18538 J. McLintock. Protective paint for ships' bottoms.
18552 A. C. Broadbridge. Steering gear for ships.
18560 F. Allen. Refrigerating machinery.
18655 W. Griffin. Anchors.
18663 W. R. Lake. Feed-pumps.
18678 D'McGregor. Utilising tidal power.
18701 E. G. Smith. Propelling ships through water.
18748 G. Quanonne. Propulsion of vessels, &c.
18749 A. Voltor. Propulsion of ships.
18767 H. Winder. Lubricator for engine cylinders.
18781 W. J. Crossley & J. Atkinson. Engines.
18820 J. S. V. Bickford. Water-tube boilers.
18882 W. T. Bell & A. Warren. Oil engines.
18916 H. Liebert. Lathe chucks.
18917 H. Monk. Friction clutches.
18930 J. A. & W. T. Purves. Revolving apparatus for light houses.
18931 J. A. & W. T. Purves. Group-flashing lighthouse apparatus.
18947 A. Ulitz. Lubricator for steam engines.
18973 R. Dawson & Co., Limited, and H. B. Kershaw. Valves for steam traps.
18986 T. McKenna. Torpedoes.
19047 J. H. Hind & T. E. Topping. Ships' doors.
19050 G. L. Lambert. Valve gear for steam engines.
19051 H. P. Holt & Mossberg Roller-bearings, Limited. Roller bearings.
19061 W. Moss. Self-acting steam escape valve.
19087 B. F. McTear. Manufacture of seamless tubes.
19093 W. B. Johnson. (J. S. Unger, United States.) Carburising armour plates.
19096 E. A. P. Henning. Driving screws on ice vessels.
19109 E. G. Pettit. Raising sunken vessels.
19131 J. Walker. Gland packing.
19137 T. Croston. Rotary engines.
19140 J. Dewrance & J. Davis. Water gauges.
19144 W. Payton. Gauge for adjusting callipers.
19155 J. Dougill. Internal combustion engines.
19164 H. Robinson. Internal combustion engines.
19180 E. J. B. Ogez. Raising boats from ships.
19181 A. R. Upward. Propeller for river boats.
19198 W. Dalton. Reducing pressure of engines.
19222 J. W. Hinckley. Oil engine.
19224 E. A. Martin. Perfected self-canting anchor.
19233 J. Pearce. Thrust blocks for screw-propeller purposes.
19236 J. Sherry. Lubricators.
19247 C. & F. Lanz. Lubricators.
19252 S. C. Davidson. Centrifugal fans and pumps.
19258 P. Boyton. Pleasure canals.
19292 F. R. Putz & J. R. Yates. Lubricators.
19310 H. C. L. Holden. Lubricators for engines.
19312 J. Worthington. Sails for propelling ships.
19321 E. Paul. Heaters and evaporators.
19404 J. A. Duff. Means for covering boilers.
19422 C. Exner. Preventing deposit of lime in boilers.
19436 F. Helm. Lubricating ring for shafting.
19458 A. D. Garretson & W. W. Browne. Cribs for docks.
19496 J. Hope & W. E. Buckley. Recording apparatus for ships.
19514 H. Fey. Reversible rotary steam engine.
19532 W. R. Wood. Mechanical stokers.
19565 E. E. Rickards. Screw propellers.
19585 Babcock & Wilcox, Limited, and G. W. Thode. Stokers.
19611 C. Snow. Steam-traps.
19621 A. Harris. Purifying feed-water.
19674 T. Le Poidevin. The drifting ships' logs.
19691 H. F. Standing. Pressure-regulating valves.
19738 W. Cromar and L. Garsides. Engine-packing.
19747 C. Angström. Tube-expanding tools.
19768 P. W. O. Hodges. Speed indicators for ships.
19770 W. J. Reynolds. Compasses for steamships.
19804 W. R. Addicks. Steam generators.
19809 R. C. Sayer. Actuating the pistons of engines.
19812 H. F. Burgess. Propelling ships.
19820 A. Gemmell and R. Frow. Steam trawlers.
19844 H. Sandford. Receptacles for storing life-belts.
19866 J. A. Secor. Means for marine propulsion.
19892 S. Rawson. Boat with life-lines.
19895 W. H. Ellam. Lifebuoy.
19898 J. Baldwin. Covering flues of boilers.
19917 J. E. Slack. Steam-generators.
19918 J. E. Slack. Purifiers for steam-boilers.
19928 Mossberg Roller Bearings, Limited. (F. O. Andrews, United States.) Roller-bearings.

19930 J. C. F. Ruck. Life-belts
19942 W. Jones. Carrying ships' boats.
19945 T. B. Browne & F. L. Martineau. Friction clutches.
19961 H. Parker. Pneumatic system for saving ships.
19973 W. Whitehead, T. Harris, & H. C. Sacré. Cowls.
20000 T. E. Bellis & T. Andrew. Tempering of steel.
20006 J. W. Fowler. Securing a ship's screw propeller upon its shaft.
20016 T. H. White. Cowl for ventilators.
20036 J. T. Watson. Construction of breakwaters.
20038 T. J. Whitney. Steam boiler feeder.
20062 D. A. & J. B. Blair & R. Baillie. Evaporators.
20063 P. W. Zimer. Managing and launching boats.
20089 A. F. Boult. Measuring funnels.
20123 M. Kryniewiecki. Lifebelts.
20129 C. B. Crawshaw & J. W. Longley. Lubricators.
20163 E. A. Mitchell. Internal combustion engine.
20179 H. W. Webb. Steering gear for torpedoes.
20187 W. Jones. Launching ships' boats.
20195 C. B. Crawshaw & D. Bannister. Lubricator.
20215 A. Pass. Removing mud by tide action.
20244 A. Winton. Lubricator for pistons of engines.
20246 W. Scott. Boilers for steam engines.
20249 A. B. MacGregor. Measuring the strength of waves.
20286 J. W. Raby. Friction clutches.
20306 S. K. Zalcman. Rowing boats.
20335 A. R. Cragg. Propulsion of vessels.
20363 W. Morgan & J. C. Nelson. Slide valves of steam engines.
20372 D. Murray. Steam boilers.
20458 A. Walbrecker. Shaft bearings.

OBITUARY.

CHARLES SHENTON DU SAUTOY.

THE death took place in Southampton, on the 8th ult., of Mr. C. S. Du Sautoy, who was for many years superintendent engineer of the Union Steamship Co. of South Africa. Fully two months ago he was suddenly seized with illness when engaged with his favourite pastime of bowls, and never recovered; his end was not altogether unexpected. He was 49 years of age, and was the son of Mr. H. Du Sautoy, who was for many years chief in the service of the Royal Mail Co., and later was superintendent of the company's works at Southampton Docks. Mr. Du Sautoy was an officer of the Royal Naval Reserve, being one of the very few men holding the rank of honorary chief engineer in Her Majesty's Navy, a distinction of which he was very proud. He was president of the local branch of the Institute of Marine Engineers, as well as a member of the central executive, and a prominent Freemason.

Notice of Removal.—Mr. Arthur Hamburger (representing Guilbert-Martin) has removed his London depôt from 1 and 2, Falcon Street, to larger and more commodious premises situated at 9, Edmund's Place, Aldersgate, E.C., where, owing to an increased stock, especially of gauge glasses, cylinder tubing, rod, and enamels, he will be in a position to execute orders more promptly.

Palermo.—We understand that a new shipyard, fitted out with the best and newest machinery, is being laid out at Palermo.

Marine Engneers' Examination.—At the quarterly examination of extra first-class engineers, held in October, Liverpool takes the lead this time again, and Messrs. Robert A. McMillan and Charles P. Parry were successful. The two candidates passed the first attempt, and were prepared at Pritchard's Marine Engineering Academy, 8, Walton Road, Liverpool, this making 10 successful candidates this year.

"**Arechondo**"—On October 24th, the steel screw steamer *Arechondo*, built by Messrs. Craig, Taylor & Co., of Thornaby-on-Tees, to the order of Mr. Antonio Uribe, of Bilbao of which we gave particulars in our October issue, page 328), proceeded to sea for her trial trip in the Tees Bay, The engines gave every satisfaction, a speed of 10½ knots being maintained on the run from the Tees to the Tyne, in the face of a heavy wind and strong tide. The owner was represented by Captain Jose R. Bollar, and Mr. F. Lawrance, of Messrs. W. Dickinson & Co., Newcastle.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

October 21st, 1899.	Coe, Alfred E. ..	Ex. 1C	London
" " "	Jones, Edmund ..	Ex. 1C	"
" " "	M'Millan, Robert A.	Ex. 1C	Liverpool
" " "	Parker, Lemuel ..	Ex. 1C	Hull
" " "	Parry, Charles P. ..	Ex. 1C	Liverpool
" " "	Reid, John R. ..	Ex. 1C	N.Shields
" " "	Ritchie, George D. ..	Ex. 1C	London
" " "	Smith, John.. ..	Ex. 1C	Glasgow

NOTE.—1C denotes First Class; 2C Second Class.

September 30th.

Arkley, John ..	1C	N.Shields
Baker, John Wm.	1C	Liverpool
Beacock, David	2C	Hull
Berrington, J.G.	2C	Liverpool
Booth, James ..	1C	N.Shields
Bottomley, R.E.	2C	Hull
Craig, Hugh C..	2C	Dublin
Dutton, Alfd. E.	1C	Aberdeen
Emslie, A. M'B.	1C	"
Findlay, Daniel	2C	"
Forman, John P.	2C	Hull
Hall, Frank S..	2C	Liverpool
Heaton, Wm. H.	2C	"
Lawson, Fred. E.	1C	London
Lilburn, Charles	2C	Aberdeen
Lowden, John ..	1C	"
McMeekin, Ed.	2C	Dublin
Morralee, Wm...	2C	Sunderl'd
Nicolle, Ph. K.	2C	N.Shields
Palmer, David..	1C	Aberdeen
Peek, Edwd. R.	1C	Hull
Ross, Walter ..	2C	N.Shields
Roy, Archibald..	2C	Liverpool
Smith, Wm.....	1C	Aberdeen
Taylor, Mark ..	1C	N.Shields
Tulloch, David..	2C	Aberdeen
Wallace, David .	1C	Londdrry
Walters, James..	2C	Liverpool
Walton, Arthur.	2C	Hull
Williams, P. A.	1C	London
Wilson, Wm. J..	1C	N.Shields

October 7th.

Armstrong, F. J.	2C	London
Brodie, Duncan.	2C	N.Shields
Brown, John	1C	Glasgow
Burke, Thos. N.	2C	Belfast
Cairns, David..	1C	Glasgow
Cappell, George.	2C	"
Cooke, John....	2C	"
Copp, Lionel T..	2C	Sthmptn
Dixon, George..	2C	Cardiff
Dockar, F. W..	2C	London
Gladstone, Jos..	2C	N.Shields
Hawker, Albt. E.	1C	London
Henry, B. A. ..	1C	Liverpool
Jackson, A. S..	1C	"
Jeffrey, Arch...	2C	Glasgow
Jessop, Jas. Wm.	2C	N.Shields
Jones, Wm J. ..	1C	London
Lewis, Jenkin E.	2C	Cardiff
Macaulay, A. F.	1C	Liverpool
Mac Callum, J.	1C	Glasgow
Mahan, W. S. A.	1C	"
McArthur, John	1C	"
McLaren, L....	2C	"
M'Dermid, N.W.	2C	Liverpool
Mitchell, R. C..	2C	Glasgow
M'Lay, David G.	2C	"
Nielsen, N. A..	1C	Cardiff
Parrott, George.	1C	"
Pascale, Stavros	2C	"
Phillips, John F.	2C	London
Pierce, Wm. H.	2C	Liverpool
Tonge, Chas. R.	2C	Sthmpton
Trenchard, Wm.	2C	Cardiff
Turner, Jas. A...	1C	"
Veness, Alfred T.	1C	London

October 14th.

Cameron, Dunc.	2C	London
Donaldson, D..	1C	N.Shields
Donaldson, L...	1C	"
Ferrie, John ..	2C	Leith
Hammond, A.E.	2C	N.Shields
Johnson, G. H..	2C	London
Johnston, Thos.	2C	"
M'Intyre, Robt.	1C	Greenock
Montgomery, G.	1C	Dublin
Morris, Arth. O.	1C	London
Robinson, G. T.	1C	"
Scott, Joseph ..	1C	N.Shields
Spence, Robt. ..	1C	"
Willoughby, H.G	2C	Cork

October 21st.

Addie, John ..	1C	Glasgow
Allan, James ..	1C	Dundee
Barclay, J. R...	1C	Glasgow
Beck, Nils C. ..	2C	N.Shields
Bone, Albert H.	2C	WHrtlepl
Bone, Robert ..	1C	Glasgow
Bowden, Geo. E.	1C	Cardiff
Boyd, David M.	1C	Glasgow
Buchanan, J. ..	2C	"
Bulkeley, T. R.	2C	"
Cairns, Jas. M.	2C	Dundee
Christie, A. E.	2C	Glasgow
Clucas, Rt. E. ..	1C	Liverpool
Cook, Chas. ..	1C	Cardiff
Cook, George ..	1C	Glasgow
Cowan, Andrew	2C	Glasgow
Davies, John B.	2C	Liverpool
Dobson, Geo. T.	2C	WHrtlepl
Dunphy, T. B...	2C	Glasgow
Dymond, E. G.	2C	Bristol
Green, Chas. R.	1C	N.Shields
Harris, Jas. W.	2C	WHrtlepl
Isbister, Jas. M.	2C	Glasgow
Jones, H. W. ..	1C	London
King, J. H.	2C	WHrtlepl
Law, Alexr.....	2C	Dundee
Liddell, Rbt. R.	2C	Liverpool
Lowdon, A. R...	2C	Cardiff
M'Clintock, H.H.	2C	Liverpool
M'Coll, John ..	2C	Glasgow
M'Cullum, A. S.	2C	"
Merchant, Isaiah	1C	London
M'Gown, John .	1C	Glasgow
Moraites, Peter	2C	Cardiff
Page, Wm.	1C	Dundee
Parker, S. H. ..	2C	Liverpool
Pearse, Wm. ..	2C	Cardiff
Phillips, C. A...	2C	London
Ralph, Sidney..	2C	Cardiff
Stephenson, F.O.	2C	WHrtlepl
Stubbins, W. G.	1C	Glasgow
Williamson, W.	2C	"
Wilson, George	1C	Liverpool
Windridge, E...	2C	Glasgow
Wregg, Frank ..	2C	Liverpool
Young, F. R. ..	1C	N.Shields

The Marine Engineer.

LONDON, DECEMBER 1, 1899.

THE Americans have decided, as far as their expert inspectors and reporters go, that submarine torpedo-boats shall be adopted for the defence of their ports. Some months ago we gave a description of the *Holland* submarine torpedo-boat as far as its details were known, which was then being developed and perfected by its proprietors. It would appear that an official test has been made with one of the boats of the proprietary company, which is one of two laid down in 1897. It is 50 ft. long, with a beam of 11 ft. and a displacement of 138 tons, and is thus smaller even than a second-class British torpedo-boat. It has only an I.H.P., as far as is known, of 50. It does not attempt to develop a speed of more than eight knots. As its power of submergence is its means of safety, it is obvious that no high speed is required, and, as its attacks are to be made by stealth, eight knots would be ample for the boat to stealthily approach its object with its fell purpose. The U.S. Naval Strategy Board stipulated that the boat should carry three torpedoes in place, and be prepared to discharge them whilst going at full speed, both when submerged and unsubmerged. The course decided was a two-mile trial off Sandy Hook, the boat to start submerged, to come to the surface at the end of a mile and discharge her torpedoes at a boat anchored near the buoy marking the end of the run. She was then to sink again and return to the starting-buoy under water. This programme was carried out, and it is stated in addition that a torpedo was fired at a target 800 yards distant, but we are not informed with what success, which latter we should consider doubtful. The Board say the test has demonstrated the boat to be equal to the requirements of the Naval Strategy Board, and Chief Engineer Lowe states that the boat is capable of making a *bona-fide* attack without being seen or otherwise detected. It is an engine of warfare of terrible potency. It would thus appear that the American engineers have succeeded, after great patience and perseverance, in perfecting a submarine torpedo-boat, which has so long been amongst the possibilities. It is, of course, reported that the French also have a submarine boat, which is said to be a practicable success and of which some are now being built. Sorry as we may all be to see marine warfare carried out by such stealthy and submerged weapons of offence or defence, we must not shut our eyes to the fact that such submarine engines of destruction appear now to be within the bounds of practical politics, and we must not be behind our friends and enemies in experimenting upon the possibilities of even such noxious insects as submarine torpedo-boats.

THE Reverend Edward Lyon Berthon, who has just died at the ripe old age of eighty-six, deserves an obituary notice at our hands. Mr. Berthon was a descendant of an old French Huguenot family of the old noblesse, his great-great-grandfather being one who survived the great massacre following the revocation of the Edict of Nantes, and escaped and settled in Lisbon, the next generation emigrating to England. The Rev. E. L. Berthon was a man of great versatility of talent, being an artist and an accomplished astronomer and archæologist; but it is as a great and successful mechanician that he is best known to the engineering world. The Berthon collapsible boat is now in use in every navy, both mercantile and fighting, of the world, and the demand for these boats gave employment to a large factory and an immense number of hands, and upon their supervision and organisation Mr. Berthon devoted much time and energy, having given up for some years his post as vicar of Romsey. The Berthon collapsible boat is no doubt well known to our readers in its present simple and perfected form, but few would imagine the difficulties presented in the task, and the persistent ingenuity required from the inventor, for the perfection of the boat in its apparently simple present form. It was first tried to make the longitudinal ribs of solid wood, steamed and moulded to form, but this was not found to answer, and eventually they were built up of a number of thin pieces, all bent on a mould bench and riveted together. When so formed they have no tendency to straighten themselves from the form in which they have been built and moulded. The flexible covering also gave much trouble. Indiarubber-coated canvas was first tried, but was not satisfactory: the rubber covering rapidly perished, and it was too dear. Eventually a paint was found which would not crack nor become sticky in any climate, and which would retain its nature for many years. Mr. Berthon's mechanical inventions were not limited to his boat. He invented many ingenious mountings for his telescopes. He dabbled also in the screw propeller, and invented a very successful perpetual log based on the principle of the difference of the level of the water in two tubes passing through the ship's bottom and terminating in nozzles of diverse directions, determining the differential height of the water and indicating the speed by inspection at any moment. In all departments of mechanical or artistic skill Mr. Berthon showed his extraordinary talent and fertility of resource, by which he would no doubt have achieved a much higher and recognised position amongst the engineering luminaries of his day, had he commenced his career by more directly adopting the profession in which he was so eminently calculated to shine.

THE Hon. Charles A. Parsons has, in his presidential address to the Institution of Junior Engineer, given many interesting details of the *Turbinia*, and forecasts as to the probable adaptability of the turbine system to vessels of a larger size. The problem of proportioning an engine of so novel a class to the screw propellers, and to the vessel to be driven, has been the subject of costly experiments extending over several years. The *Turbinia* was commenced in 1894, and after many alterations and preliminary trials was only satisfactorily completed in the spring of 1897. A satisfactory solution has been found, giving very economical results in regard to pounds of steam consumed in the engines per effective H.P., which are equal, or superior, to those so far obtained with triple-expansion engines of ordinary type in torpedo-boats or destroyers, and with almost a total absence of vibration at the extraordinary speeds realised. The arrangement adopted is that, instead of placing, as usual, one engine to drive one shaft, the turbine engine is divided: two, three, or sometimes more separate turbines each driving a separate screw shaft, the steam passing successively through these turbines as a high-pressure, intermediate, and low-pressure engine successively. As to the propellers, they approach closely to the usual form, but it has been found best to place two propellers of approximately the same pitch on each shaft at some considerable distance apart, so that the after one is out of the wash of that in front. Cavitation behind the blades of the propellers also gave much trouble at the high speeds of rotation required, such cavitation commencing when the mean thrust pressure on the projected area of the blades exceeded 11¼ lbs. per square inch. On each of the three shafts of the *Turbinia* are three propellers, making nine in all. The water-tube boiler with which she is fitted has 1,100 ft. of total heating surface and 42 square feet of grate area. The turbine motor is now being applied to two torpedo-boat destroyers—one, the *Viper* for our own Government; and the other, a similar vessel for Sir W. G. Armstrong, Whitworth & Co. The boilers are 12 per cent. larger than in such a destroyer, and it is estimated that 10,000 H.P. will be realised from them. The estimated speed for going ahead is 35 knots for these vessels, and upwards of 32 knots has already been reached in the preliminary trials of one of these boats, and at the time of going to press it is reported that 37 knots has been attained. The conditions appear to be favourable to Mr. Parsons for the application of motor turbines to cross-channel boats, fast passenger vessels, cruisers, and liners, the absence of vibration, with enormous speed and lighter draught of water, being obvious advantages. Mr. Parsons considers it possible to build a light unarmoured cruiser of, say, 2,800 tons displacement, to travel for about eight hours at 44 knots.

THE American naval constructing yards are now seriously competing with the British yards in carrying out orders for foreign navies. The construction of the Russian battleship *Retvizan* is progressing in Cramp's yard at Philadelphia. The plates are being provided from Messrs. Carnegie's works under the Krupp process, and some 5-in. plates for the quick-firing battery have proved most successful in their resisting power. The plates showed no sign of perforation with 5-in. shells, and consequently no reliable figures are available as to its ultimate resisting power. At any rate, such Krupp process plates are at least more than equal to a wrought-iron plate of 2½ times its thickness. It is only in the British Navy at present that the quick-firing batteries will be found to be protected by anything like resisting armour to this extent; and, should foreign navies now adopt armour of this degree of resistance, heavier quick-firers, such as 7·5-in. or 8-in. guns, will be required to do any execution. The battle, therefore, between armour and guns is still being waged in as lively a manner as ever, the application of the Harvey and Krupp's process to steel plates having now more than doubled the defensive value of the armour weight for weight as was the case with simply wrought-iron plates.

PATENT DROP RUDDER.

THE advantages of a rudder forward, as well as one at the stern, have been recognised for many years, particularly in vessels plying in waters where the navigation is rendered difficult by the presence of a large amount of shipping, or the available passages are narrow, or the currents are strong. For example, some of the excursion steamers on the Thames are, we believe, provided with fore and aft rudders. The difficulty, no doubt, has hitherto been to arrange the rudder in an effective position, and house it snugly and securely when not required.

We have now the pleasure of describing and illustrating an arrangement of forward rudder, which, as far as our knowledge goes, has considerable novelty. In the adjoining diagram Fig. 1 is a side view of the rudder projecting downward from its tube or housing. Fig. 2 is a vertical section on the line *A B* in Fig. 1. Fig. 3 is a transverse section on the line *C D* in Fig. 1. Fig. 4 is an outside longitudinal elevation of a boat fitted with this rudder.

The main feature of the device is that it is a drop rudder, and, therefore, can be drawn up within the body of the hull when not required, thus not forming an obstruction to the progress of the vessel in its inoperative position. It will be seen from the illustration that the rudder is mounted within a narrow elongated tube, or housing, formed in the hull of the vessel with an opening through the keel into the water below. The rudder, which is of the balanced type, is attached to a stiff rudder-post, which latter is journalled at its lower end in a bearing held in vertical guides carried by the tube, so that it can slide up and down therein. When the rudder is drawn up into its tube the bearing is carried up with it.

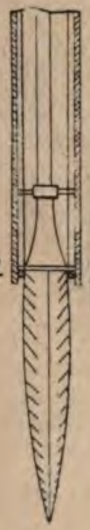


FIG. 2

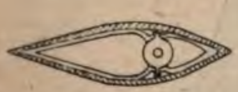


FIG. 3

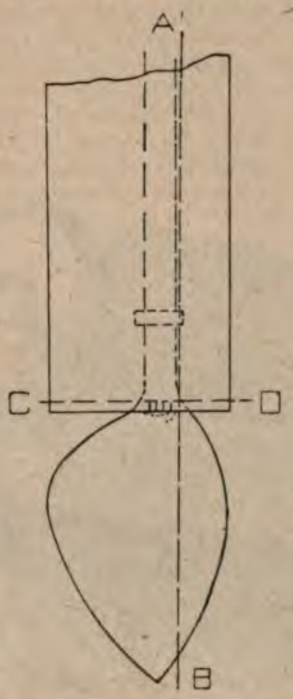


FIG. 1

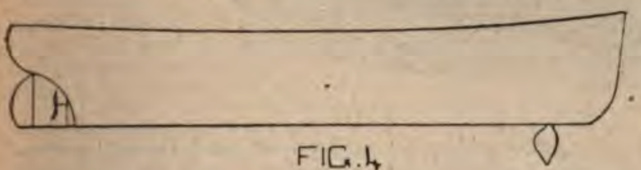


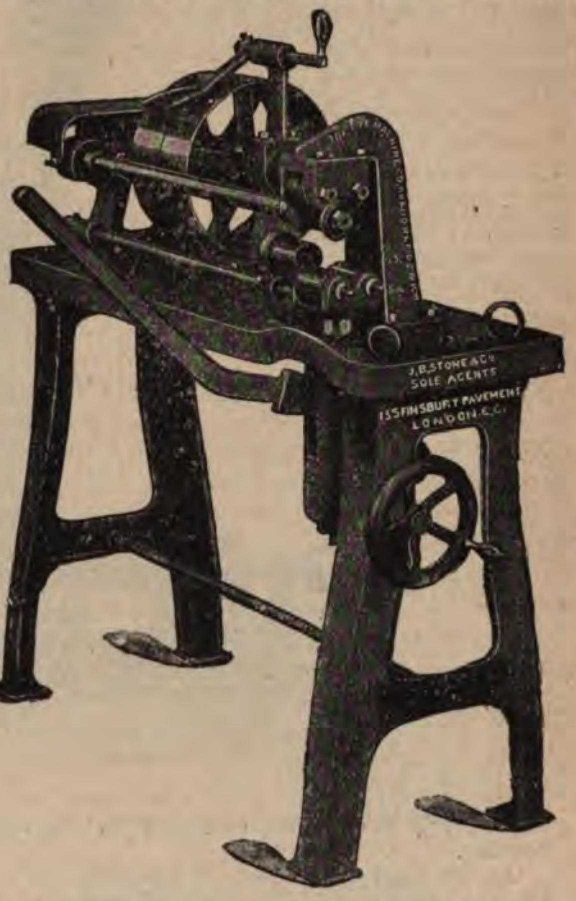
FIG. 4

It is a matter of common knowledge that with the ordinary stern rudder the angular displacement of the ship is mainly effected at the after end, whereas with a rudder at either end it can be displaced angularly at both ends, or the ship can be displaced laterally in a diagonal direction, maintaining the axis of the ship parallel to the direction it had at the commencement of the steering operation.

Further, if required to check the vessel's progress, it can be turned through 90 deg. to a position normal to the direction of motion. It forms a reserve rudder in case of damage to the stern rudder, and when a vessel is hove to will keep it in the eye of the wind. It is claimed that in stormy weather it steers better than the ordinary arrangement, as the force of the wind has a greater disturbing force forward than aft. In a cross sea it makes the steering easier owing to its being balanced, and in the case of sailing yachts it is stated that it holds them better to windward, is more effective, and not so detrimental to speed as the old-fashioned arrangement. The device is being put upon the market by Mr. W. O. A. Lowe, of 86, Leadenhall Street, London, E.C., and c11, Queen Insurance Buildings, Liverpool.

THE FOX TUBE OR PIPE CUTTING MACHINE

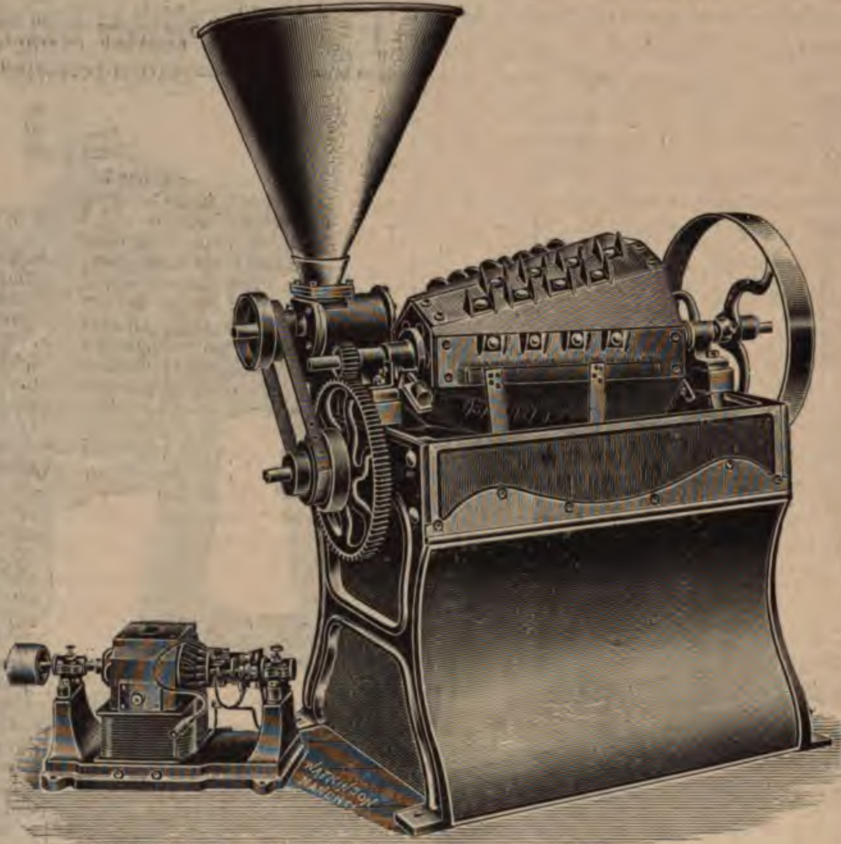
THE machine which we illustrate in the adjoining diagram is another example of the ingenuity and ability for adaptation possessed by American toolmakers. It has been specially designed to cut heavy tubing, such as boiler tubes, steam and gas pipes to length, quickly and accurately.



It will be seen from the illustration that the machine is constructed on the same general principles which obtain in ordinary tube cutters, with the exception that it is specially designed to withstand very heavy pressures.

The driving shaft is heavily geared to the shaft carrying the cutting disk, the latter making one revolution to three of the counter shaft. All the gearing is cut and the pinions are of steel. The bearing rolls are of hardened steel and large in diameter. The lower rolls are carried in an adjustable bearing block, which is elevated and lowered by the hand wheel shown on the end of the machine, the motion being transmitted by means of bevel gears. In this manner these rolls may be almost instantaneously adjusted to cut pipes and tubing from ⅜ in. to 2½ in. outside diameter.

The proper adjustment is that which brings the pipe just clear of the cutting disk when pressure on the hand lever forces the pipe up against the rotary cutter, quickly separating the tubing. The hand lever terminates in a cam directly under the plunger which carries the lower bearing rolls, and will elevate them ⅜ in., the handle returning to its original position.



On the shaft at the back of the cutting disk is a hardened steel sleeve, which in turn bears against the two anti-friction rolls at the top, thus distributing the upward pressure of the cut over a large surface. An adjustable stop is provided to take material up to 6ft., so that duplicate pieces may be rapidly and accurately cut.

It is interesting to note that upon actual test an ordinary piece of steam pipe 1 in. in diameter was cut in 10 seconds, and a piece 2½ in. diameter in 30 seconds. The fast and loose pulleys are 12 in. diameter, and 3 in. face, and run 450 revolutions per minute. This machine is put on the market by Messrs. J. B. Stone & Co., 135, Finsbury Pavement, London, E.C.

PATENT ELECTRO-MAGNETIC SEPARATOR.

THE accompanying illustration shows an improved patent apparatus for separating iron and steel particles from brass and other cuttings, and which is already in successful use in several important engineering works and brass foundries. This machine is being introduced by Mr. J. F. Butterworth, 28, Queen Street, London, E.C., has been named the patent "electro-magnetic" separator, and the following description of its leading features will be of interest to our readers. The apparatus consists of a rotating conically-shaped drum, in connection with a trough, and carrying on its periphery a number of electro-magnets arranged in rows. These rows of magnets are connected by wires to each other, and also to a segmental brass rings fixed in insulated segments concentrically to each end of the drum, each segment receiving the wire of one row of magnets. On each side of the segmental rings is arranged in contact an annuler brass ring, which always exposes about a third of the segmental ring, and these annuler rings are connected to a suitable electric source. They are stationary in relation to the segmental rings, and set up against their sides by means of springs. The trough underneath the drum runs parallel to the periphery of the latter, and extends a short distance below its centre, its upper end being formed with a hopper furnished with a feed-worm, and its lower end with an outlet. The metal cuttings to be separated are placed in the hopper and conveyed by a worm to the trough. When the drum is rotated the rows of magnets passing under the annuler ring are magnetised, and, in going through the cuttings, pick up the iron or steel filings; whilst as each row of magnets leaves the ring it instantly becomes demagnetised, and the iron or steel cuttings fall by gravitation into a receiver underneath. The conical form of the drum causes the filings as they are separated from the iron or steel particles to be gradually carried forward and discharged into a receiver. As will be seen, the special feature of this separator is the introduction of electro-magnets instead of permanent magnets, which enables them to be controlled, and secures a constant magnetic, force which is not obtainable with the permanent magnets hitherto mainly in use. Another feature is the patent automatic knock-off motion already described, whereby the magnets are demagnetised for a small portion of each revolution, allowing the iron collected to drop into the receiver, and leaving the magnets free for a new collection. It is claimed that this separator will give a largely-increased output as compared with that obtainable from other machines, averaging 2 to 2½ tons per day, and no skilled labour or attention is required. It is supplied either separately or with its own dynamo, and requires about 1 H.P. to drive the combined arrangement. Where electric current is available the separator can be adapted to suit the voltage of supply.

THE FLEETS OF THE MAIL LINES.

(*From our own Correspondent.*)

Details of the Remarkable Voyage

of the steamship *Waikato* are now to hand. The vessel in question has achieved the distinction of reaching the port of Fremantle in no less than 157 days after sailing from London. She started on her usual trip to New Zealand ports on the 4th May of the present year, and in due course passed Teneriffe and the Cape. The latter was sighted at 7 p.m. on the 3rd June, and almost immediately the ship's troubles began. The first things to go wrong were the air-pump guards, which caused three stoppages of the machinery in the next two days. But the real trouble occurred at 2 p.m. on the 5th of June, when the tail-shaft broke in the tube. Owing to the position of the fracture repairs of any kind were out of the question. The vessel would not steer and had to be allowed to drift. Attempts were continually made to make her navigable, both by the setting of additional canvas, made from the vessel's awnings and such like, and by the laying out of sea-anchors. But till the 28th July—a period of 55 days—nothing was sighted. Then the Liverpool barque *Tacora* came along and tried to take the big unwieldy steamer in tow. Her attempts extended over a period of three days, but the weather was unfavourable, and she was in slight collision with the tow on no less than three occasions. At last she bore away, taking with her the first news that the *Waikato* was still afloat. In consequence of her report H.M.S. *Melpomene* was sent out from Mauritius to look for the helpless vessel, but she managed, after 17 days' cruise, not to find her, keeping, as the event proved, too far to the northward all the time. Three days after the departure of the *Tacora* the Danish barque *Aarlborg* was spoken, and took away some letters. Another 30 days passed before the next craft—the *Banca*, of Glasgow—was seen and then the weather did not warrant the sending away of a boat. On the 8th of September, only six days after the previous sighting of a vessel, the *Alice*, of New York, came up. She provided the *Waikato* with some provisions, and also with sails to replace those which had been lost. Five days later another sailer was sighted, and at last on the 15th September the sight of a steamer's smoke told the prisoners that the *Asloun*, the vessel which was to prove their deliverer, was at hand. They had then been drifting for 102 days in an absolutely aimless manner, going in every direction over a comparatively small stretch of the Indian Ocean at the mercy of wind and current. The *Waikato* is reckoned to have traversed in that time a distance of 4,552 miles. The average movement was thus about forty-five miles a day. The master of the *Asloun* promised to tow the *Waikato* into Fremantle, the port to which his own ship was bound, the distance being no less than 2,521 miles. He mentioned, however, that he had only 17 days' coal in his bunkers. But that fact was not allowed to interfere with the result, for the two ships proceeded to Amsterdam Island, a tiny rock, which lent them some little shelter whilst under its lee, and there in the ships' boats a hundred tons of coal from the bunkers of the *Waikato* were transferred to those of the *Asloun*. This operation was accomplished on the 20th and 21st September, all the boats of the *Waikato* being employed. It was not got through without difficulty and some risk, for the vessels drifted away from the land, and had to steam back into position, with the boats astern. The voyage was resumed on the 21st, but the *Waikato's* dangers were not over. In very heavy weather on the 28th September the hawsers broke and the vessels lost sight of one another. So heavy was the weather on this occasion that the *Asloun* actually started her funnel with her rolling. Next day, however, the towage was recommenced, and continued till Fremantle was reached without further incident on the 8th of October. The experience of those on board the *Waikato* must have been a very trying one. A diet of tinned sardines in the first place must have been horribly monotonous, when it extended over so many months, but the strain of watching for help, which was at first so disappointing, and in effect so long delayed, at all events in effectual form, must have been far worse. It says much for the officers and men in both the navigating and engineering departments that there was no trouble on board, and that when the coaling was suggested all hands turned to with a will on what seemed so unpromising and dangerous an operation.

The settlement of the award for the *Asloun's* services will be awaited with some interest.

La Compagnie Generale Transatlantique

seems bent on renewing and modernising its fleet. The old steamer *Washington*, built as a paddler on the Clyde as long ago as the year 1863, has been disposed of, and two new steamers have been purchased for the new cargo line to New York. This service, as will be remembered, was opened a few months ago with the Lund Line *Wooloomooloo* and the French steamer *Chateau Lafitte*. The new departure seems to have been justified, for now these two large vessels are being purchased. They are both modern steel vessels belonging to well known British lines. Both were constructed in the year 1891. One which will in future be known as the *Bordeaux*, is the Johnston liner *Sedgemore* of 4,332 tons gross, and of a length of 406 ft., built at Liverpool by the Messrs. Royden. She was fitted with triple-expansion engines by Messrs. J. Jones & Co., of the same city. The other vessel was the Wilson liner *Francisco*, now to be called the *Pauillac*. This vessel has about three hundred tons greater gross tonnage than the *Sedgemore*, though she is about thirty feet shorter. She was built and fitted with a set of triples by the well known firm of Messrs. Robert Stephenson & Company, of Newcastle. These purchases following that of *L'Acquitaine*, and the commencement of the new mail boats, looks as though the company intended to keep itself well to the front in the future.

The Condition of the River Thames.

In last month's Notes I mentioned the deplorable condition of the River Thames, whereby the Atlantic Transport Company's *Marquette*, inward bound from New York, lost 12 hours in getting into Gravesend. It appears that this delay, irritating and expensive as it is to the owners, will—unless very vigorous measures be taken by those using the waterway—only be the beginning of their trouble. The owners of the *Marquette* are building two steamships, at least, of the size which Liverpool shipowners find most profitable, namely large carriers which can be loaded down to a 30-foot draught. No attempt is being made by the Conservancy to deal with the work which is coming to it. It says it has no means to pay for the necessary dredging, and that the work which provision for such large vessels would entail would cost it a couple of millions. It further says that in view of the small number of ocean steamers frequentin “ port, and the large number—*number* and not *tonnage* remark—of small craft entering the navigation, it is unnecessary to provide for big vessels, which will only be subjected to a "little" detention and "slight" inconvenience if things remain as they are. This thing is nonsense, as the experience of all other ports worthy of the name either in Great Britain, Germany, the Netherlands, Canada, or the United States—if they would engage in the Atlantic passenger or cargo trade—has shown. It now becomes a question whether Londoners are so enamoured of the Thames Conservancy that they will keep it and its mediæval ways of thought and of action in preference to their supply of grain and of meat. If they keep the former, and retain a museum of men with fossilised ideas, they will assuredly lose their big cargo trade, and will also have to pay railway charges as well as freight on the vast majority of the food-stuffs that supply their tables.

The Transports.

A good deal of nonsense has been talked in the daily press about the mismanagement of the Admiralty in regard to the transport of the Army Corps to the Cape. It has been asked why such vessels as the unfortunate "Z's" were taken, and steamers of the class of the *Lucania* and the *Oceanic* were left. The answer to that is easy enough. The engagements of vessels like the *Oceanic* and the *Lucania* are constant and pressing, and are made long beforehand. Anyone who looks into the Admiralty Court when a case of salvage by towage is being tried, and who hears something of the engagements, both in prospect of herself and of her line, which attend the working of even an Atlantic cattle boat, will understand this. Had the Government been in a position to go round a few weeks before the war was sprung upon us by the Boers, and ask the shipowners to reserve them tonnage, they could—at a price reasonable enough considering its value and its engagements—have secured the finest ships that fly the blue ensign. But when war came it was sprung on the Government. The vessels of the highest class were either at sea or about to sail. The Admiralty merely asked tonnage of the class it usually takes. It got it, and got it to the extent of the whole steam tonnage of nearly any mercantile marine save our own. It got it, too, at very fair average rates, and without in any way dislocating the trade of the empire. True, it has stiffened rates of freight a bit, and—in conjunction with other factors—sent up the price of coal; but our mail lines are still carrying on their business, and our cargo boats still bring in our daily bread and meat. Naturally, at the first call, the spare boats of the mail lines were offered—so, too, in the case of the mixed passenger and cargo lines. These were the best ships available, save perhaps the new steamers preparing for sea which were in a position to be hurried forward and completed for troopships, perhaps sooner than their passenger fittings could be put into them. Where the Admiralty went wrong was in taking vessels that were out of a job. That it only did in a couple of cases, and those errors which it made early in the business could have been avoided if its officials had had five minutes' conversation with an intelligent chartering clerk in the city of London. What is much more to the purpose is the consideration of three things. First, how it was that the proper loading of the transports was neglected, and that some of them were sent to sea too light, when they might have taken out coal for the home trip and so saved the country very large sums of money. Secondly, why the temporary fittings, alike for horses and men, were so long being put aboard, and why they were of the character which was chosen, which, in many cases, is not that which the best experience of those engaged in the trade of horse-shifting and man-carrying recommends. Lastly, why bad food for men and horses was accepted from rascally contractors. These things will have to be gone into thoroughly when the war is over. At present I merely note them. But the conduct of Mr. R. P. Houston, M.P., alike in regard to his *employes*, to the Government, and to faulty stores, should not go without a word of recognition.

Amid the nonsense that has been talked I notice one statement that should have a specific contradiction. The *Arawa*, now of Messrs. Elder, Dempster & Company's fleet, is in no sense a sister ship, as has been so repeatedly stated, to the *Zibenghla* and the *Zayathla*. She is younger, larger, and comes from a different yard. She even belonged to a different fleet. The only characteristic she has in common with the vessels in question was the fact that at one time she was engaged in the same trade with them. The delays which she suffered were in no way due to her propelling machinery, and she made an excellent passage as far as the Canary Islands.

The "Tainui,"

which is really a sister to the *Arawa*, in the most exact sense of the word, has just changed hands. Since her departure from the New Zealand trade she has been variously employed, most recently in the Allan Mail Line between Liverpool and the St. Lawrence. It is now announced that she has been acquired by the Anchor Line, and she left Liverpool for Glasgow on the 20th November.

Further Transports.

As the time goes on and the needs of the Admiralty are more appreciated by shipowners, the class of vessel available has much improved, in speed, at least, though in other regards the great majority of the vessels taken are quite as good as need be. Amongst the latest charterings are the new steamer *Sicilian*, of the Allan Line, which has not yet made a voyage; the *Canning*, of Messrs. Lamport & Holt; the *British Princess*, of the British Shipowners Company; and two famous Atlantic passenger boats, the *Majestic*, of the White Star Line, and the *Canada*, of the Dominion Company. The Admiralty has undoubtedly got speed in these vessels if it can use it. Yet I cannot but think that the general public will be highly disappointed with the passage of a 20-knot Transatlantic liner if the authorities treat her as they have treated their previous chartered ships. A vessel to do herself justice must be loaded according to certain ascertained principles well within the knowledge of everyone connected with the mercantile marine. She must have hold of the water, but she must not be laden too deeply, and the adjustment of weights with regard to the diminution of coal supply and provisions during the trip must not be lost sight of. The ship must be stable and yet not too stiff. Yet in their treatment of the ships the Admiralty has hitherto despatched, all these elementary propositions seem to have been quite ignored, and, crowded as they were with all manner of stores, it is not surprising that slow runs were made. If the ships had not been staunch indeed there might have been worse disasters than the breaking of the thrust shaft of the *Persia*, which up to now is the only real breakdown to be chronicled. The steam-tug *Blazer*, of Liverpool, which has done so much good service in the past, was opportunely at St. Vincent when the *Persia* broke down, being there to tow home a disabled Italian steamer, and she quickly brought the transport into safety.

The "Kaiser Wilhelm der Grosse"

is steadily cutting away at her own record and making the task more and more difficult for any who should be bold enough to desire to take it from her. Leaving Southampton on the evening of the 22nd October, she reached New York at 11 a.m. on the 28th, having steamed 3,047 nautical miles in five days 17 hours, and 48 minutes. This shows an average speed of 22 knots. She was turned round very rapidly at both sides of the Atlantic, and sailed again from Southampton on the 15th November. This time she again achieved a diminution of her time from Cherbourg, but I have not yet obtained details of her performance.

The Hamburg-American Line

has sustained a serious loss in the burning of their fine steamship *Patria* in the German Ocean. This vessel was a twin screw four-masted steamship of about 6,600 tons gross, built at Stettin by the Vulcan Company. She was but five years old. Homeward bound from New York to Hamburg with 150 passengers, 120 crew, the mails, 16 valuable racehorses, and a large and valuable general cargo, she passed Dover, apparently all well. on the morning of the 15th November. Some four hours later at 11 o'clock, an alarm of fire was raised. With incredible speed it seemed to spread, and though every effort was made to combat it, it was found necessary to put the passengers into the boats. This difficult work was safely accomplished; a Russian steamship, the *Ceres*, soon picked them up and landed them at Dover by means of a tug. Of the passengers it may be said that all was well, save that the shock was too much for one of them, who succumbed shortly after landing. The crew stuck to their ship manfully. But though help was forthcoming from the company's steamship *Alesia*, an attempt to tow the burning vessel into Hamburg proved impossible. Captain Frohlich had at last to remove his men, and the vessel was abandoned. Attempts were made by various ships to take her into some port but without avail. At last the Hamburg Line's *Hansa* (to which Captain Frohlich himself and another experienced commander of the line had been transferred) got hold and made for the English coast; the German tug *Simson* came to assist and a British cargo boat got a line out aft to give the tow steerage way. But off Deal the ill-fated vessel's sides burst open, and she went down in about seven fathoms of water aft. Her bows just showed. She is, however, a total loss, being completely gutted. So fierce was the heat, fed on such combustibles as linseed, wax, oats, and bran in the cargo, that the steel decks melted. Nothing seems to have been saved except human life. The mails, racehorses, psssengers' and crew's effects, all were lost. It is a merciful thing indeed that the disaster occurred in perhaps the most crowded waters of the world and in calm weather. Had it taken place in darkness and storm at sea the results might have been dreadful to contemplate.

The "Oceanic"

has seen some real Atlantic weather on her third outward trip, which she made with a full complement of passengers against heavy wind and seas from the westward. She has by her behaviour confirmed the reputation her first performances won for her, being very easy in her movements, and quite free from vibration. Her passage on this occasion was about six days eight hours, though she was never pressed, and, at times, was reduced to less than two-thirds of her power. The weather on the worst day was noted as having increased to a hurricane. Yet against that she did 377 nautical miles, and did it without inconveniencing those aboard of her. The time of her eastward passage was spoiled by a detention at New York, on account of fog, which kept her inside of Sandy Hook till fifteen hours after her usual sailing hour.

The Manchester Liners, Limited,

which was registered last year, started its business with two steamers, the first of which was called, after it took her over, the *Manchester Enterprise.* This vessel is now reported as having foundered in the North Atlantic on the 15th November, whilst on a voyage from Manchester to the St. Lawrence. The steamer in question was originally named the *Queensmore.* and was built in 1890 for the Johnston Line by Messrs, Gourlay Brothers, of Dundee. Her length was 360 ft., and her gross tonnage under 3,800 tons. The Manchester Liners, Limited, has since it acquired its first ships ordered seven further vessels, six of which are already in the water. They have all been constructed on the East Coast. Their size is much more ambitious than that of the vessel now lost—running in the case of the *Manchester Corporation*, built at Hartlepool by Messrs. Furness, Withy & Co., up to 5,367 tons gross register.

Shipbuilding Companies.

Messrs. Vickers, Son & Maxim find the expansion of their business—which, of course, includes that of the old Naval Construction and Armaments Company of Barrow—so great that they seek to raise a further three quarters of a million sterling. This it is proposed to obtain by the issue of a quarter of a million £1 shares, at a premium of 200 per cent. So prosperous are they that it is thought that the existing shareholders will feel it a favour to be allowed to take up this allotment, premium and all, in proportion to their present holdings. Messrs. John Brown & Company, who recently purchased the Clydebank yard, offered 500,000 new ordinary shares at a 50 per cent. premium in August, to aid them in paying for their new acquisition, which was valued at something over a million sterling. They now propose to make an issue of 48,000 preference shares of £10 at a 20 per cent premium, whereby a sum of £480,000 more should be realised. The money is required to complete the purchase of Clydebank. From the prospectus some interesting information is obtainable. The shipyard was taken over on the 2nd of September last. The establishment has acquired new machinery within the last four years to the extent in cost price of over a quarter of a million. It has unexecuted contracts on hand whose aggregate value is over three millions. These include the construction of five large Atlantic liners, a battleship for Japan, and three first-class cruisers for the Royal Navy.

Bristol.

In last month's Notes I expressed a doubt as to whether or not it were worth while discussing the Bristol City Council's latest proposals for improving the facilities of the port. Whilst the notes were being printed, the whole scheme was withdrawn by its author, Alderman Proctor Baker, who found, just as he was going to the meeting which was to confirm the direction to go to Parliament for powers, that the suggested new service had fallen through. Thus he felt bound to give the matter up. The time for entering new schemes is now past, and Parliament cannot therefore be asked to sanction any proposals for improvements in the Avon for another year. Meanwhile, by order of the Postmaster-General, Messrs. Elder, Dempster & Company have been obliged to remove their weekly mail line of Canadian steamers from Bristol to Liverpool, and so Bristol is already worse off than she was before. In this connection—though it no longer concerns Bristol directly—it is well to notice that the *Lake Erie*, the first of the twin screw vessels specially designed for this mail service, was launched on the 18th November. She is the first of a fleet which next year will tend to make the St Lawrence competition even keener than it has been of late. The trade will, however, it is said be relieved next season of one competitor, for it announced that Messrs. Frederick Leyland & Company intend to put their vessels now running to the St. Lawrence into the New York trade as an opposition to the White Star and Cunard Lines.

THE BABCOCK & WILCOX MARINE BOILER.

THE resurrection and revival of the water-tube boiler, and its successful employment for naval purposes, has naturally raised the question as to whether such boilers cannot be used with general advantage in the mercantile marine; and, as might have been expected, the opinions expressed by engineers have wide points of difference, varying between the extreme opinions that there is nothing to hinder their immediate adoption, and that such boilers are not, and never will be, fit for mercantile steamships.

It is but fair to state that the controversy, both in political and professional circles, has practically revolved round one particular form of water-tube boiler, so that the general merits of the case have been, no doubt, confused, and in many instances entirely lost sight of.

We propose in this article to give our readers some small idea as to what is being, and has been, done by Messrs. Babcock & Wilcox, Limited, in the matter of water-tube boilers afloat.

We will first direct our readers' attention to the adjoining illustrations, of which Fig. 1 shows a cross section and front elevation of a boiler as fitted in passenger and cargo steamers. This boiler has about 2,750 square feet of heating surface, 58 square feet of grate surface, and a working pressure of 225 lbs. per square inch, and with natural draught will develop about 8,200 H.P. Turning now to Fig. 2, we see a perspective view of one of the four boilers which have been fitted in H.M.S. *Sheldrake*, whilst Figs. 3 and 4 show respectively a longitudinal sectional section and front elevation of the same boiler.

It will no doubt be remembered that the *Sheldrake* is a torpedo gunboat of the *Salamander* class, with twin-screw triple-expansion engines of 3,500 H.P. collectively. The total heating surface in each boiler is 2,356 square feet, and the grate surface 63 square feet The boiler pressure is 200 lbs. per square inch, reduced at the engines to 150 lbs., the steam on its way passing through separators.

There are 19 sections of tubes in each boiler. The tubes throughout are of solid-drawn steel, galvanised on the outside. The diameter of the tubes connecting the headers and iron boxes is 1 13-16ths diameter, and their length about 7 ft. 6 in. The uptake headers are connected to the steam and water drum by 4-in.

tubes, the down tubes being the same diameter. The level of the water is regulated by Thornycroft's feed-water regulators. In the trials these boilers were found to be capable of burning 42·2 lbs. of coal per square feet of fire-grate, and of evaporating 337 lbs. of water per square feet of fire-grate.

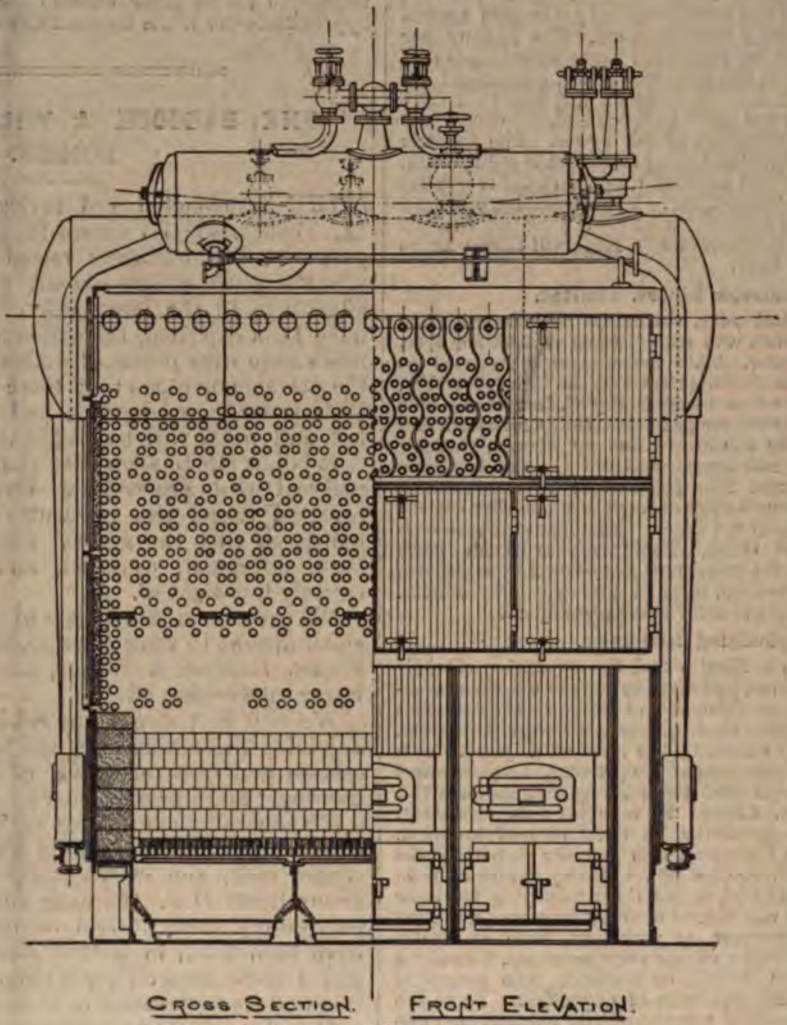


Fig. 1.—The Babcock & Wilcox Marine Boiler.

Fig. 5 shows a view in the boiler-room of the cruiser *Chicago*, of the United States Navy. This illustration gives a very good general idea of a stokehold of a vessel having water-tube boilers. This cruiser is the one that was appointed for service in South African waters. During her first commission this vessel made very long voyages to different parts of the world, and it will be remembered she visited the Mediterranean last year.

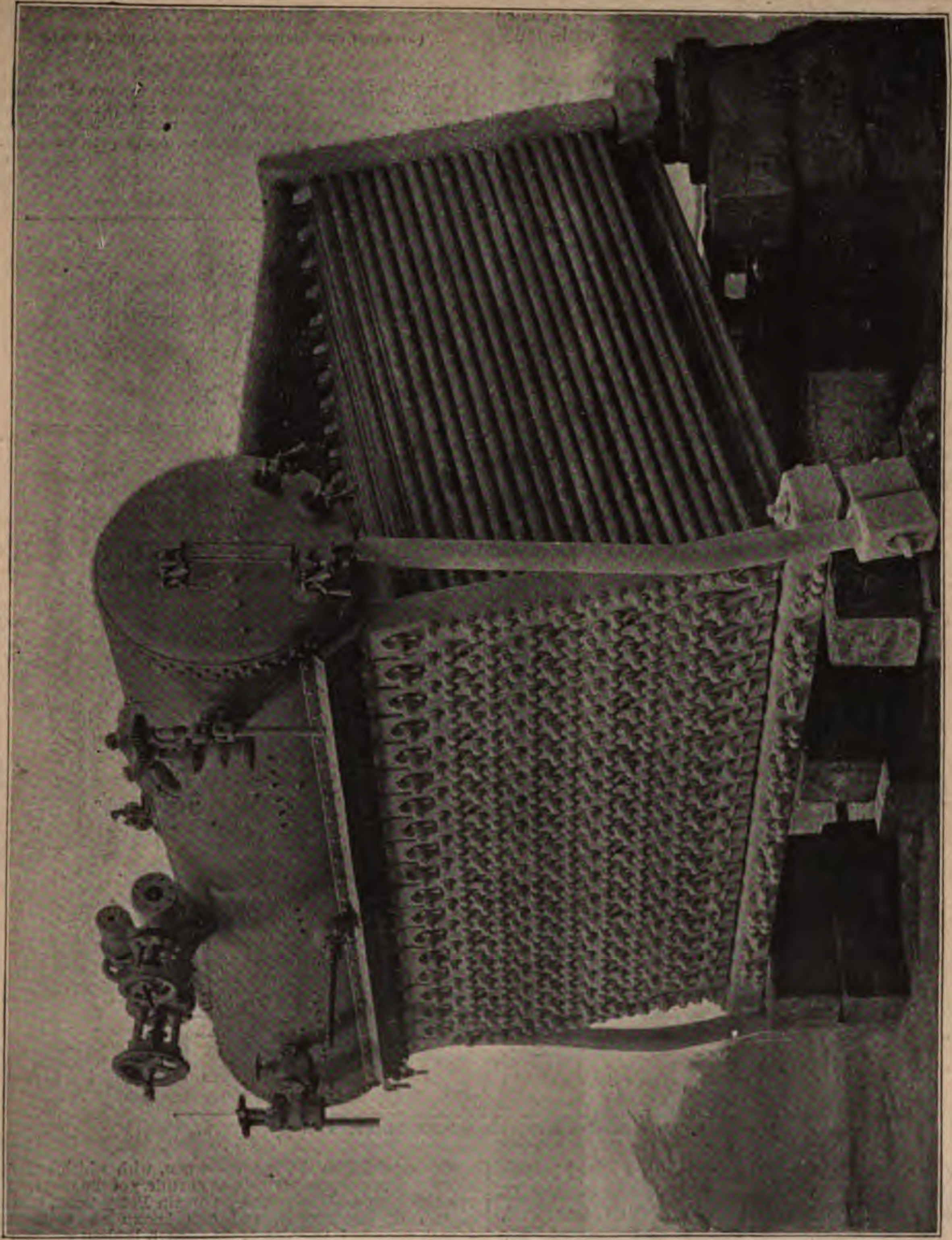
The boilers have, we understand, worked very well, and, as tending to bear out this fact, it may be mentioned that the United States naval authorities have since fitted their cruiser *Atlanta*, the monitors *Canonicus*, *Manhattan*, and *Maliopac*, their cruisers *Alert* and *Wyoming*, and one of their latest large cruisers, the *Cincinnati*, with eight boilers of an aggregate of 5,000 I.H.P.

With regard to the mercantile marine, it may be mentioned that Messrs. Wilson, of Hull, have these boilers fitted in eight of their vessels, and we would make special reference to the s.s. *Tasso*, which is fitted with two water-tube boilers. The vessel was fitted at the commencement of this year, and has made a number of voyages with good results.

This vessel was originally equipped in 1893 with ordinary shell boilers, and the results of the first six voyages with water-tube boilers, together with details of corresponding voyages when the vessel was fitted with ordinary boilers, are given by Messrs. Wilson as follow :—

	Ordinary boilers.	Water-tube boilers.
Total distance..	9,472 ..	.. 9,200.
Total consumption of coal ..	1,072 tons	.. 981 tons.
Average speed..	11·45 knots	.. 12·5 knots.
Average coal per voyage ..	178½ tons	.. 163½ tons.

This shows in favour of the water-tube boilers to the extent of a saving of 90 tons of coal burnt and a gain of ·6 knots in speed, a result calculated to be equal to 130 tons of coal saved per voyage assuming the speed to be the same with both boilers. In this ship there were only two men on each watch, one stoking and



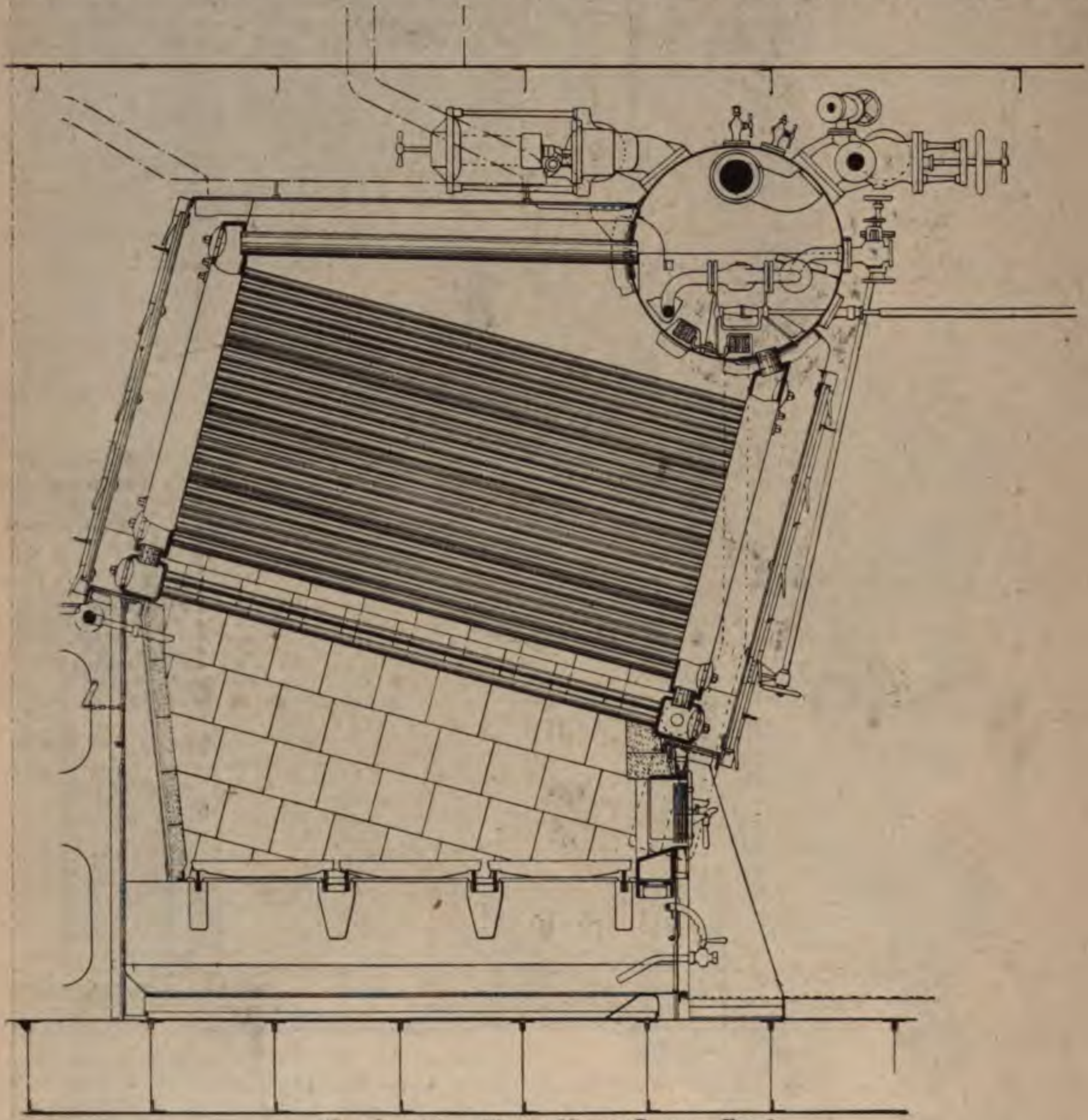
The Babcock & Wilcox Marine Boiler. Fig. 2.

the other trimming, getting out the ashes and assisting to clean the fires.

It was found by actual experience on the trial that the feed-water to the boilers only required regulation about three times per hour, and when it is considered that the firemen on board were entirely new to the ship, and had not had any previous experience with water-tube boilers, the results may be set down as highly satisfactory.

Messrs. Babcock & Wilcox, Limited, have recently booked an order to fit one of Messrs. Wilson's large passenger boats, the s.s. *Martello*, employed on their Hull to New York and Boston service, with four of their marine type water-tube boilers.

This contract is excellent evidence of the opinion of Messrs. Wilson in regard to these boilers, as they have been gradually adopting this type of boiler for seven years past. The firm have also received an order from the British Government for a set of boilers for H.M.S. *Espiegle*. Further, they are making 15 boilers for sand-pumping dredgers for the Queensland, New South Wales, and Indian Governments, the dredgers being built by Messrs. Sir W. G. Armstrong, Mitchell, Whitworth & Co., Limited, of Newcastle.



THE BABCOCK & WILCOX MARINE BOILER. FIG. 3.

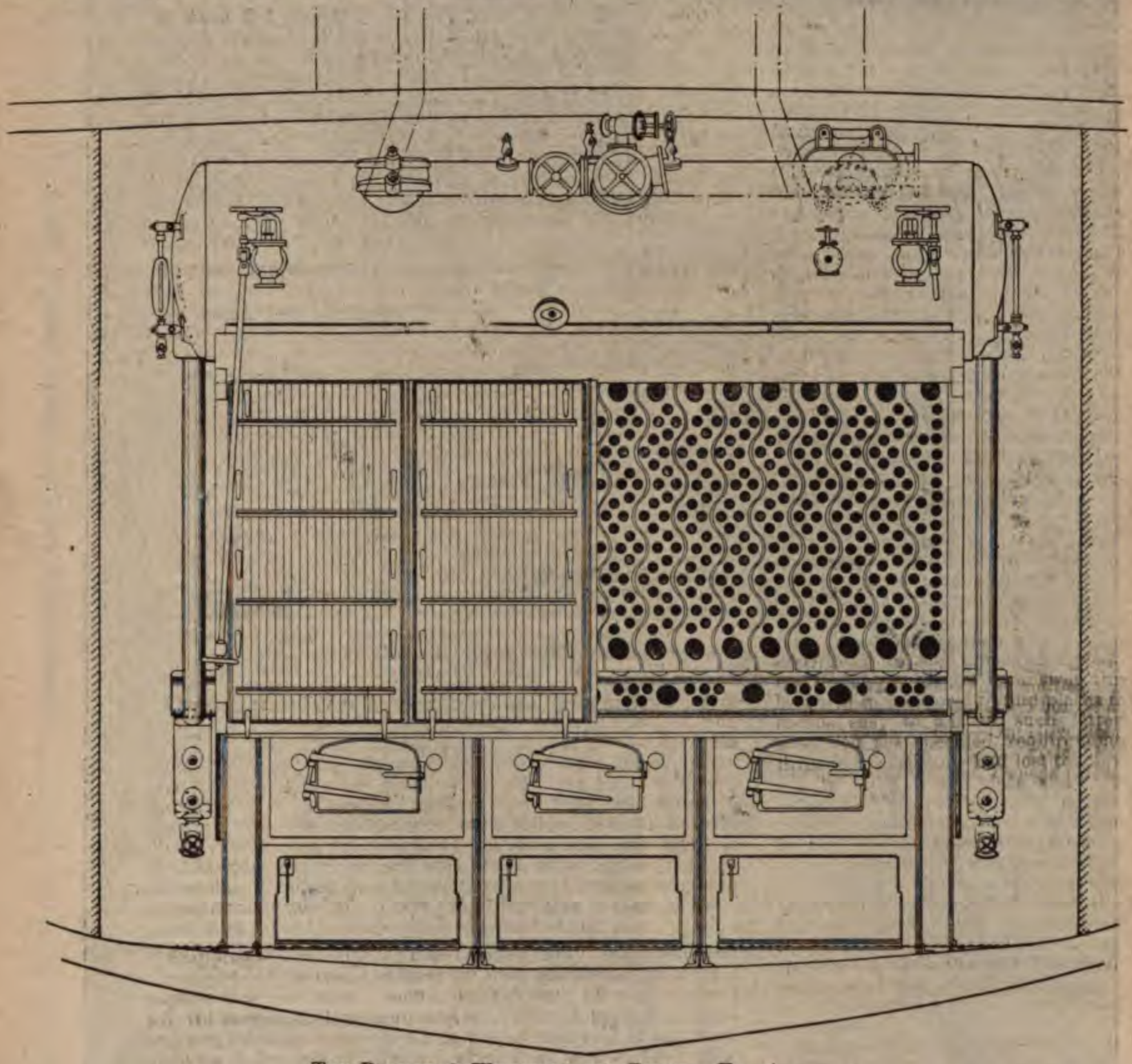
Wireless Telegraphy.—A system of wireless telegraphy is being installed between lighthouses on the French coasts.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

The Navy and the War.

THE Navy has once more come to the assistance of the Army in time of trouble, and the manner in which the "handy man" manœuvred his guns at Ladysmith is the subject of praise from all. It appears that we could produce nothing more powerful than the 15-pounder gun, with which our field artillery is armed, against the heavy artillery of the Boers. But the Navy came to the rescue. Captain Percy Scott, now the captain of the *Terrible*, and well known as a gunnery expert, conceived the idea of building a landing carriage on which some of his guns, as a matter of fact never intended for land service, could be made use of to assist our artillery at Ladysmith. He called together his senior assistant engineer and a couple of engine-room artificers, and between them a carriage was designed, the parts made, put together, and the first gun mounted on it, in a couple of days. The 12-pounder gun which



THE BABCOCK & WILCOX MARINE BOILER. FIG. 4.

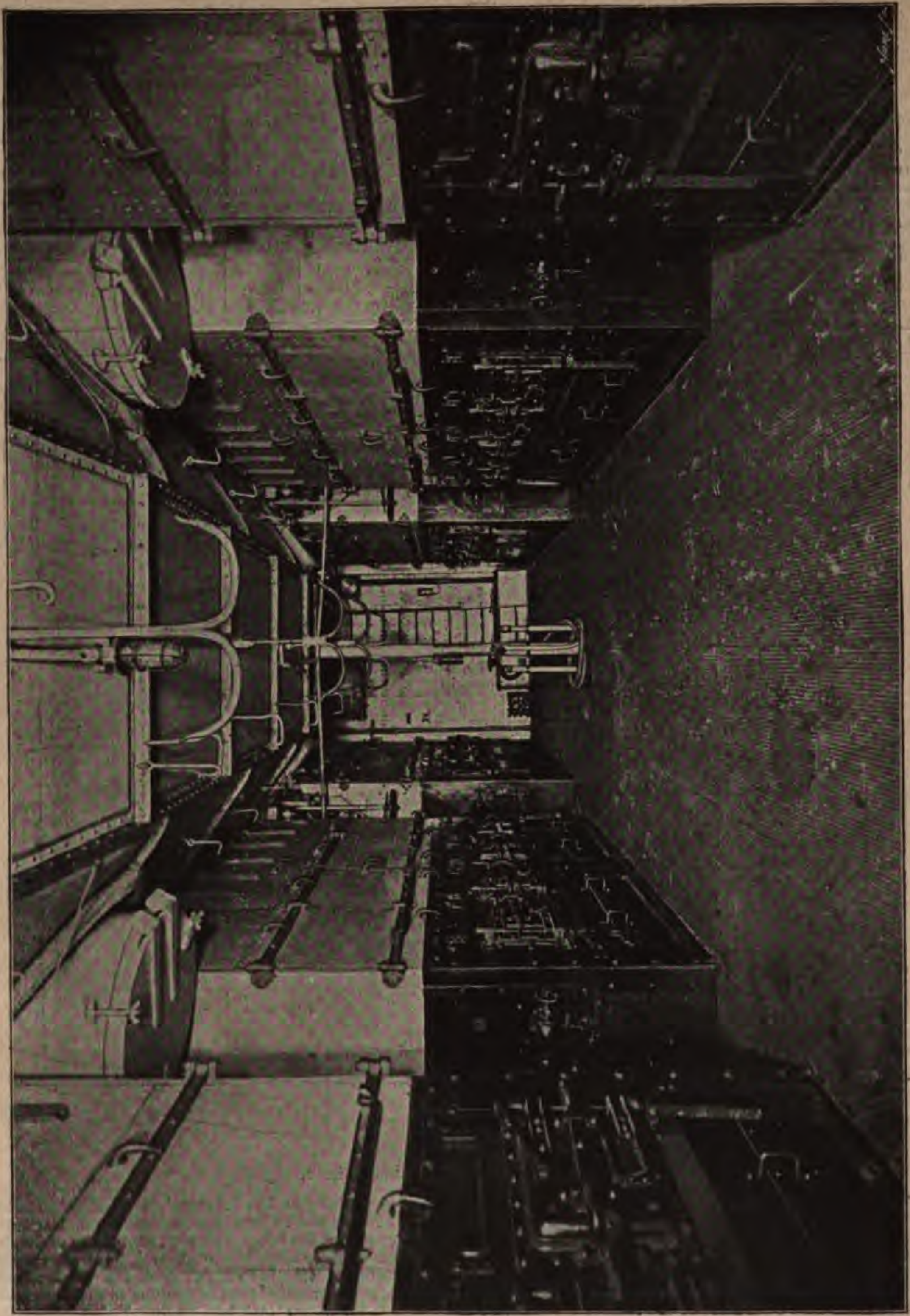
Captain Scott has transformed into a field piece has a muzzle velocity of 2,200 foot-seconds, a muzzle energy of 423 foot-tons, and can perforate over 8 in. of iron. Captain Scott also designed a mounting for the 4·7-in. naval gun by simply bolting a ship's mounting down on to four pieces of pile. At an extreme elevation the lyddite shell fired went 12,000 yards against 9,000 yards of the 12-pounder. The experiment has been a complete success. Four properly equipped Naval Brigades have been landed, and the seamen have proved their worth on many occasions since they have left their ships. Unfortunately, they have not been able to carry out their work without some loss: in addition to several men being wounded and killed, Commander Egerton received injuries at Ladysmith which first of all necessitated both his legs being amputated, and subsequently caused his death. Had he survived he would have been entitled, as he had been promoted to the rank of commander, to a special pension of £500 a year in addition to the ordinary service pension. Universal regret has been felt at his death, which is a serious loss to the Navy.

Executive and Engineer.

Admiral Melville, in his annual report on the working of the Steam Engineering Bureau of the United States Navy, makes some remarks which lead one to believe that the amalgamation of the executive and engineering branches has not proved as successful as was expected. He had hoped, as indeed had many others, that the whole trend of detail would be towards the complete amalgamation of executive and engineering interests in the Navy, with a favourable outlook for the protection of the rapidly advancing engineering science. There is still a hope, however, and a well founded one, that the comprehensive union of the executive and engineering vocations will before long be brought about. Briefly, he says, the fate of the reconstruction of the *personnel* hinges upon the provisions made for future and continuous supply of efficient engineers in the Navy. The duties of the executive branch were believed to be perfectly compatible with a professional excellence in engineering matters. A not unwarranted expectation was that preference for the mechanical part of these combined duties would be shown by a great number owing to the intense interest attaching itself to this field of work and to its almost universal application to the progressive arts of the age. Although something of disappointment seems to have affected the admiral, he considers that the only plausible scheme is to insist upon the present executive officer adapting himself as soon as possible to the new conditions and increasing, where lacking, his knowledge of mechanical engineering.

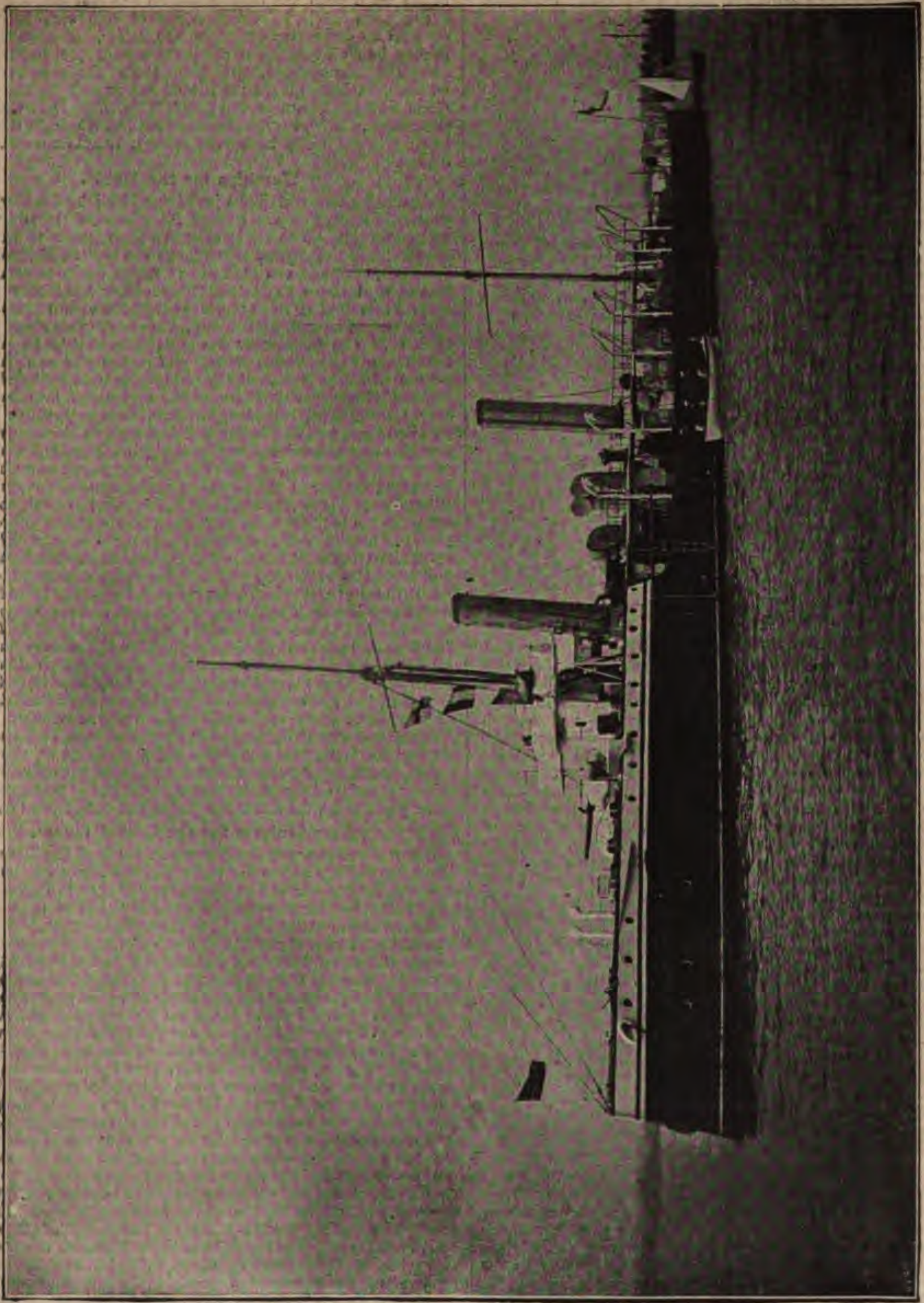
Portsmouth Dockyard.

A great many vessels are expected to leave this yard in the course of the next week or so, either to supersede ships on foreign stations or to convey crews to vessels recommissioning. The *Bellona* was to take up the work of the *Blonde* in the Iceland fisheries, but has been ordered to proceed to Gibraltar, and



BOILER-ROOM IN THE U.S. CRUISER "CHICAGO." FIG. 5.

there to await further orders. The *Tyne* is to take out new crews for the *Polyphemus*, the *Imogene*, and the destroyers *Ardent*, *Boxer*, *Bruiser*, and *Dragon* in the Mediterranean, and the *Latona* is to take out a relief crew for the *Indefatigable* on the North America and West Indies Station. On the 5th of this month the *Canopus* commissions for service in the Mediterranean, provided her services are not required elsewhere, and the *Scout* relieves the *Nymph* on the same station. The *Glory* is to arrive at this yard on the 5th inst., and is to be completed for sea before April. It is a curious fact that the galley and pinnace of the *Glory* are to be painted royal blue. Altogether some very special instructions have been given in



H.M.S. "SHELDRAKE," FITTED WITH FOUR BABCOCK & WILCOX BOILERS, 3,500 I.H.P.

connection with the preparation of the vessel for the pennant. The inference is that the Duke of York will hoist his flag as Rear-Admiral on her. The only signs given of the floating out of the *Pandora* is that the Admiralty inquired about a week ago whether her cost would be materially increased by her completion being postponed from March to July. As so much has been made of the fact that some of the 4·7-in. guns of the *Terrible* have been moved from Durban to Ladysmith, it is interesting to note that, as soon as it was known that this had been accomplished, designs were prepared, and men kept at work all day and through the night in building suitable carriages for sending such guns across country. A number of these improvised carriages were dispatched last month. The dispatch of transports from this dockyard has been considered a most creditable performance. The *Arawa*, for instance, was prepared for sea in five days, and on the sixth day embarked the Shropshire Light Infantry at Southampton.

The New Navy and the Old.

The old Training Squadron with its picturesque but practically useless masts and sails, has at last given way to a squadron composed of steel ships propelled entirely by machinery—another victory for steel and steam over canvas and hemp. For many years past our seamen have learnt the mystery of spar and sail drill in the old vessels, but after all quickness of eye and limb, steadiness of nerve, resourcefulness, self-reliance, and calmness in sudden emergencies can be learnt equally as well by a spell of service in torpedo-boats; and the experience thus gained will be found more useful to the men in after years than the knowledge of how to handle sails. From the point of view of the picturesque and artistic, the change is to be regretted, but then it must be borne in mind that our ships are not ornaments, but hard, matter-of-fact fighting machines. One can easily sympathise with Lord Graham, who, in his letter to the *Times*, defends the now defunct Training Squadron. Probably the masted warships would have been able to hold their own with similar vessels belonging to other nations, but then one cannot always pick and choose the class of vessel with which to grapple. Lord Graham suggests the continuance of the use of the vessels now dispensed with, and thinks that boys might be drafted straight from the receiving ships into the Training Squadron, instead of into a modern man-of-war, thus doing away with the necessity of teaching men the use of old guns after they have grown accustomed to modern ones. As regards the development of the chest and other parts of the body, there is no doubt that our seamen felt the benefit of their stay in the old Training Squadron, and it is quite true that none were ever the worse for a turn under canvas; but sails must in course of time give way entirely to steam, and therefore it is better that our seamen should learn their profession in modern cruisers.

The Conduct of the Navy.

The report issued dealing with the conduct of the Navy for last year is a most interesting one. When reading it, however, the size of the British Navy should be taken into account, also the fact that seamen are by nature more reckless and regardless of consequences than either soldier or civilian. The report shows that 149 cases of striking or attempting to strike a superior officer were dealt with by court-martial, including 25 outbreaks on the part of marines; 46 cases of wilful disobedience were also dealt with, and other serious breaches of discipline, including desertion, improperly leaving a place of duty, drunkenness, and using threatening language. Happily there are only 57 criminal offences against the common law, comprising 44 cases of theft and embezzlement, seven forgeries, and six cases of disgraceful conduct. Out of the 187 courts-martial held upon seamen of the Royal Navy, 199 persons were accused and punishments inflicted in 191 instances; 103 men were sentenced to imprisonment and dismissal, with or without disgrace, and 78 to imprisonment with hard labour. The only serious increase is in the number of offences against superior authority, but even in this case it must be remembered that the *personnel* of the Navy has been augmented by nearly 30,000 men since 1888. In that year there were 140 offences against discipline tried by courts-martial, but in 1892 this number had been reduced to 105 cases, to be increased in 1898 to 253 cases. Altogether there cannot be said to be anything very startling in these figures, for the misdeeds of a few hundred bad men must not be taken as a proof that 100,000 good men are going "to the dogs."

Devonport Dockyard.

The part of this yard devoted to shipbuilding will before long present as busy an appearance as ever. Early next month the first-class battleship *Montagu* will be laid down, and a good deal of the material to be used in her construction is now in readiness. She is to be built on slip No. 2, and contrary to custom no attempt is being made to commence her before the keel is officially laid. However, as soon as a start is made, she will be advanced as rapidly as the *Bulwark*, or any other of her predecessors that have been built at this yard. The *Blonde*, after all, is to have a new set of boilers, this time on the water-tube principle. The job will probably cost about £20,000, and, as the Keyham Factory is at present choked up with work, she will probably be attended to at a private yard. The decision to supersede the obsolete cruisers of the Training Squadron by modern vessels raises the question as to what is to be done with the *Calypso*, which has just had over £10,000 spent upon her. In consequence of this step it has been decided to discontinue work on the *Active*, but a good deal of money has already been spent upon her. Yet another signal book has disappeared, this time from the gunboat *Magpie*, which left here in the middle of last month for the Cape of Good Hope. There is not much hope, now that the *Magpie* has sailed, of discovering the offender, but if caught his punishment will certainly be severe enough to act as a deterrent to others.

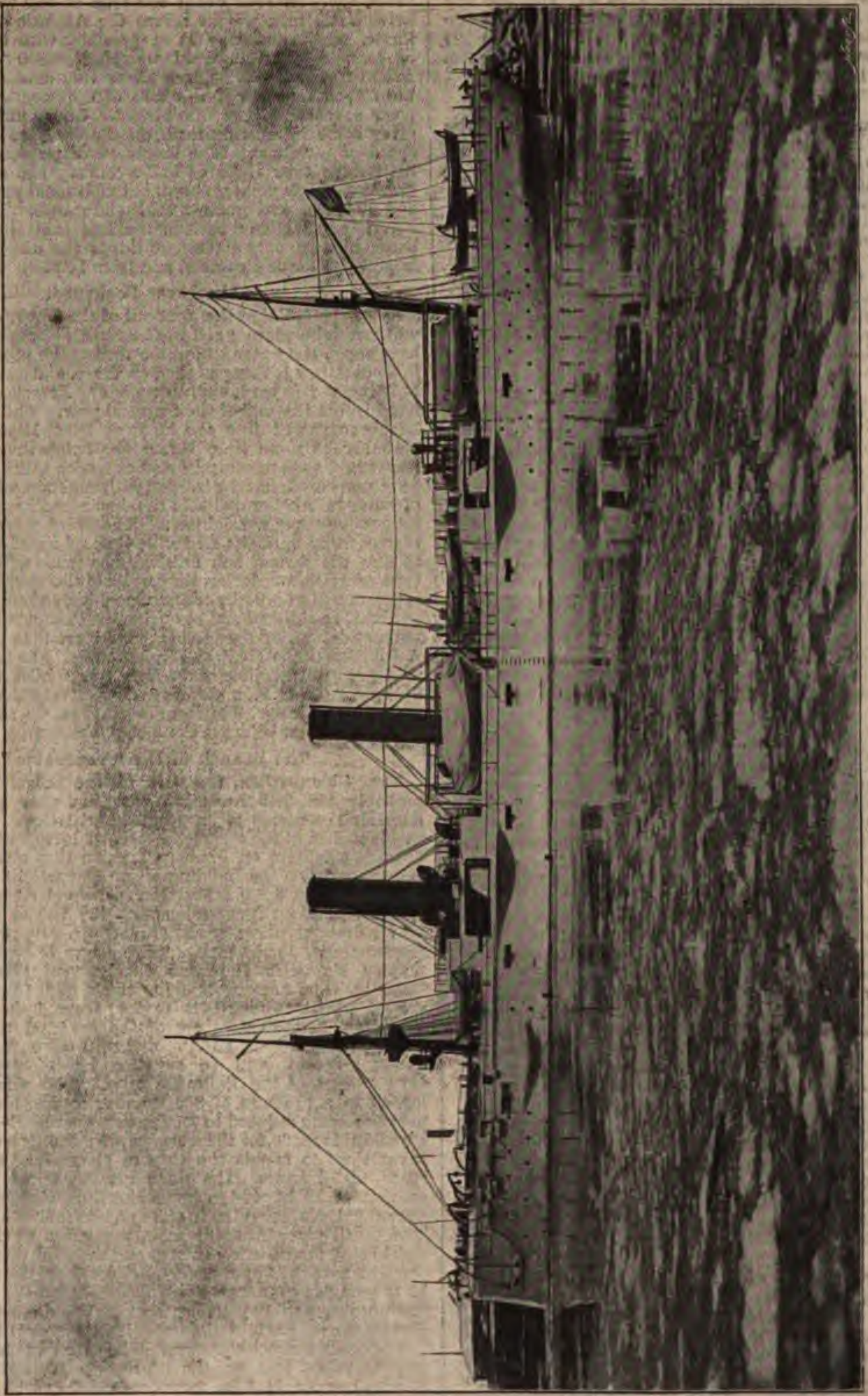
Warships for the World.

According to a statement just issued by Lloyd's, there are at present building in the United Kingdom 52 British warships and 30 foreign. The paper affords a comprehensive view of the shipbuilding in progress throughout the United Kingdom. The vessels mentioned are said to be "under construction," which means that those mentioned may either have only just had their keels laid or are not quite ready for steam trials. Warships are, of course, incomplete, even when this stage has been reached, for in most cases the guns have still to be placed on board and the vessel fitted out before she can hoist the pennant, but she is nevertheless out of the builders' hands. From the list it appears that there are 14 warships building at the Royal dockyards, including two first-class battleships building at Chatham, two at Devonport, and two at Portsmouth; one first-class armoured cruiser building at Pembroke, one first-class protected cruiser, and the Royal yacht; one third-class protected cruiser building at Chatham, and four sloops at Sheerness. Altogether the displacement of these vessels amounts to 125,920 tons. At the private yards there are 38 vessel at present under construction, with a total displacement of 205,430 tons. At Barrow there are three vessels building; one first-class battleship and two first-class armoured cruisers. At Birkenhead there are six vessels building, including two first-class battleships, two sloops, and two torpedo-boat destroyers. Three first-class battleships are building at Blackwall, and one at Jarrow. Two first-class armoured cruiser are building at Clydebank, one at Glasgow, and three at Govan. One second-class protected cruiser is building at Glasgow, two gunboats at Liverpool, one torpedo-boat destroyer at Chiswick, three at Clydebank, two at Govan, four at Hebburn, one at Hull, four at Jarrow, and one at Sunderland. As regards foreign vessels there are 68 building at the private yards, including seven armoured vessels, one protected cruiser, nine torpedo-boat destroyers, 11 torpedo boats, and two river gunboats, with a total displacement of 287,060 tons.

New Cruisers for the United States.

Some interesting particulars are to hand of the Denver class of cruisers which are to be built for the Navy of the United States. Altogether six of these cruisers are to be laid down, and their speed when completed is calculated to be 16½ knots. Length of load water line, 292 ft.; length, extreme, 308 ft. 2 in.; breadth, extreme, about 43 ft.; mean draught at trial displacement, with two-thirds coal, ammunition, and stores, 15 ft. 6 in.; extreme draught, fully loaded, 16 ft. 8 in.; trial displacement, about 3,100 tons; full load displacement, about 3,400 tons; coal carried on trial, 470 tons; total bunker capacity, not less than 700 tons. The engines are of the four-crank triple-expansion type. The armament will consist of ten 5-in. breechloading rapid-firing guns, eight 6-pounder, two 1-pounder rapid-firing guns, and four Colt machine guns. The 5-in. guns will be more effective than the old type. Eight of them will be mounted on the main deck in recessed ports. The two remaining 5-in. guns will be mounted behind shields on the spar deck, one forward and one aft. Four 6-pounders will be mounted on the main deck, two forward and two amidships, and four more on the spar deck. The two 1-pounder guns will be mounted aft on the main deck, and the Colt machine guns on the top of the hammock berthing amidships. The coal capacity of these ships with bunkers full (700 tons) is sufficient to give them a radius of action at full speed of about 2,600 miles. At the most economical rate of steaming, probably in the neighbourhood of 10 knots, they should be able to steam about 9,800 miles without recoaling, or more than sufficient to take them from San Francisco to Manilla. The ammunition supply will be large. For each of the 5-in. guns they will carry 260 rounds, and for each of the 6-pounders 500 rounds.

The wood material used in the construction of the hulls will be reduced to a minimum. All the bulkheads on the gun and berth decks will be of metal, and they will each be fitted with



U.S. Cruiser "Chicago." *(See page 388.)*

a pilot house on the spar deck built entirely of non-magnetic metal. The main engines, of which there are two sets, each driving a propeller, are of the vertical inverted cylinder direct-acting triple-expansion type, having cylinders:—High-pressure 18 in. diameter, intermediate-pressure 29 in., and two low pressure 53½ in. diameter, 30 in. stroke. The I.H.P. of the combined engines is to be 4,500 when the engines are making 172 revolutions per minute, with a boiler pressure of 275 lbs. reduced to 250 lbs. at the high-pressure cylinder.

Chatham Dockyard.

The defects which were discovered in the machinery of the *Goliath* during her steam trials in October have now been set right, and her official trials have been resumed. At her eight hours' run on the measured mile her engines will be expected to develop 13,500 H.P. and a speed of 18 knots. All her guns are now on board, with a staff from the Portsmouth School of Gunnery, who are to superintend her gun trials. On the completion of her trials she is to take the place of the *Centurion* as flagship on the China Station. The damage which the torpedo boat *Cheerful* recently sustained has now been attended to, and she is to resume her trials almost at once. The launch of the *Venerable* was, as might have been expected, a brilliant success. On the slip she has vacated a new battleship of the *Duncan* class is to be commenced. She will displace 14,000 tons and will have triple expansion engines capable of developing 18,000 H.P. More than £100,000 will be spent upon her during the current financial year. The *Irresistible* and *Pioneer* are being completed as rapidly as possible, and a great deal of work has been put into them despite the hurry necessary for the preparation of the transports *Idaho* and *Algeria* for the conveyance of the Royal Field Artillery to the Cape. On the 7th of this month the *Dryad* leaves for the Mediterranean Station. The *Terpsichore* is also expected to be sent to the China Station before long, and the *Argonaut* will probably leave for foreign waters shortly. The *Arethusa* is now on her way to the Pacific to relieve the *Amphion*. The *Ariadne*, first-class cruiser, and the *Coquette*, torpedo-boat destroyer, have been passed into the Fleet Reserve, and are to be kept ready for use. The refit of the *Blenheim* is also practically finished, and the *Archer* has now been passed out of dockyard hands and formally handed over to the Reserve.

The German Navy.

The new shipbuilding scheme which the German Emperor seems desirous of carrying out has not met with much favour outside the columns of the official publications. The scheme has not yet been officially announced. According to the Navy Bill passed last year no further expenditure was to be asked for for six years. Within the first three years it was proposed to lay down seven battleships, one of which was the *Kaiser Karl der Grosse*, recently launched, and two armoured cruisers of the *Fürst Bismarck* class. Five battleships were to be laid down in the course of the second three years to take the place of the *Bayern*, *König Wilhelm*, *Kaiser*, *Baden*, and *Deutschland*. However, the increased cost of materials, and the delays caused by advances in constructive principles, may render it impossible to commence more than three ships during that period with the means provided. According to the new semi-official scheme, however, it is proposed to lay down three ships yearly during the sexennate. The scheme as set forth by the *North German Gazette* involves the increase of the non-recurrent expenditure under the head of naval construction from £3,000,000 to £4,350,000, and an increase of the other non-recurrent outlay from £450,000 to £600,000, with the addition of £250,000 to the current expenditure. But it is doubtful if even this additional money would be sufficient to pay for the ships it is proposed to lay down. The present shipbuilding programme extends to 1904, but between this date and 1911 the Emperor would like to see the building commenced on ten battleships, and between 1911 and 1917 eight more, in addition to cruisers and torpedo-boats.

The Progress of Steam Navigation.

In last month's *Cassier's Magazine* is published a most interesting and instructive article on the progress of steam navigation during the last 60 years. It is contributed by Sir William White, the Director of Naval Construction, and from it one gathers that during the period mentioned the speed of warships has been increased from 8½ to 22½ knots; ships have more than trebled in length, about doubled in breadth, and increased tenfold in displacement. The engine power has been made 40 times as great, and the ratio of H.P. to the weight driven has been increased fourfold, chiefly owing to the institution of fast steaming torpedo-boat destroyers. The rate of coal consumption measured per H.P. per hour has, however, decreased, as it is now only about one-third of what it was 60 years ago. In 1840 about 550 tons of coal were necessary to drive 2,000 tons weight across the Atlantic at a speed of 8½ knots, whereas to-day it is possible, with only 3,000 tons of coal, to drive a vessel weighing 20,000 tons across the Atlantic at 22 knots. Three times this amount of coal would have been required if the rate of coal consumption had not been so considerably diminished. Sir William White also gives some interesting facts on the increase in the size and speed of warships. The increased displacement of modern battleships over those of half-a-century ago does not merely give the vessels greater speed, but additional powers of offence and defence, and greater coal endurance. The Director of Naval Construction mentions the fact that the largest of our battleships are only about two-thirds the displacement of the largest passenger steamers, and from 200 to 300 feet shorter.

Sheerness Dockyard.

It is expected that the float-out of the *Shearwater* and *Vestal* will not take place until next month although they were to have taken the water some time during the present month. A little overtime is being worked on these, and on the other sloops building at this yard, as the *Condor* and *Rosario* should be out of hand before the end of the financial year. The gunboat *Speedy* has been passed into the Medway Fleet Reserve, but it will probably be some time before she hoists the pennant. The *Sheldrake* has been commisioned as tender to the *Rodney*. It will be remembered that she is fitted with the Babcock & Wilcox type of water-tube boiler and that she has recently undergone some interesting experimental tests. The third vessel is the *Sharpshooter*, fitted with the Belleville type of water-tube boiler. As soon as the *Seagull* has finished her trials with the Niclausse type of water-tube boiler, the results of the working of the three types of boilers will be collected and published. The *Skipjack* gunboat, re-boilered and re-engined at Palmer's, is to be finished without delay, and the vessel to once more take her place in the A Division of the Medway Fleet Reserve. She has been refitted with water-tube boilers of the Reed type, whilst her new engines indicate 6,000 H.P., an increase of 2,500 over that developed by the late machinery. The *Perseus* and *Prometheus* should be ready for the pennant before the end of this month.

The Launch of the "Venerable."

Mrs. Chamberlain, the wife of the Colonial Secretary, is probably the first American who has ever performed the launching ceremony to an English battleship. The *Venerable* was launched at the commencement of last month and was laid down at Chatham on January 2nd, so that she has been just eight months on the building slip. Her weight when she took the water was 5,200 tons. Her principal dimensions are:—Length, between perpendiculars, 400 ft.; extreme breadth, 75 ft; draught of water, forward, 25 ft. 2 in.; aft, 22 ft. 3 in.; displacement, 15,000 tons. The bottom is coated with Hartmann's Rahtjen's Improved Composition (The Red Hand Brand). The armour is 9 in. thick and 15 ft. deep amidships, whilst forward it varies from 3 in. to 7 in. in thickness. The engines are of the inverted triple-expansion type, having 15,302 I.H.P., and will give a speed of 18 knots. Steam will be supplied by 20 separate water-tube boilers of the Belleville type. The safety valves are loaded to a pressure of 300 lbs. per square inch, the steam pressure being reduced to 250 lbs. per square inch at the engines. Provision is made for the stowage of 2,040 tons of coal, which is sufficient to enable the ship to steam for thirty days at a speed of 10 knots. The main armament of the *Venerable* consists of 12 in. 46-ton breech-loading wire guns of the improved pattern, mounted in pairs on turntables in the barbettes. The auxiliary armament mainly consists of 12 6-in. guns, eight being placed in casemates on the main deck, and four in casemates on the upper deck. Besides these the ship will carry 16 12-pounder guns, equally divided between the upper and the main decks, two 12-pounder boat and field guns, and eight ·45 Maxim guns. Each of the two military tops will be fitted with three-pounder Hotchkiss guns. The vessel has four submerged torpedo tubes, two on the broadsides forward and two aft. She will carry 14 8-in. torpedoes, and five 14-in., the latter being fitted with dropping gear from the ship's steamboats.

Cheating the Government.

The severe remarks of Mr. Justice Grantham, when summing up the case brought by the Admiralty against a contractor named Bligh, were more than justified. This person was sued for damages in respect of the defective manner in which he had performed a contract, in the neighbourhood of Sheerness and below Chatham, of a defensive work for the prevention of torpedo-boat attacks up the Medway. He undertook to construct a boom made up of steel hawsers supported by piers, but these piers were so badly secured that the whole erection was rendered practically useless thereby. The work done showed that the defendant must have deliberately made up his mind to commit a fraud. An examination of the bolts used showed that a number of them were mere spikes given the appearance of bolts, and the concrete at the bottom of the piers had been deliberately omitted, as the mud had not been cleared to form the foundation. The contractor denied that he had been guilty of any fraudulent collusion with the Admiralty assistant engineer. Mr. Justice Grantham said he considered that when a person broke a contract in which the safety of the country was concerned, he ought to be dealt with as a criminal. If it was not a criminal offence, it ought to be made one. The jury returned a verdict for the full amount claimed. Another unsatisfactory business which calls for attention is the delivery of rotten hay as food for the horses which are being transported to South Africa, and the fact has also been made public that stinking meat was placed on board another vessel as food for the troops. Whoever is responsible for such iniquitous proceedings should be made to pay the penalty for such crimes.

Pembroke Dockyard.

The new Royal yacht is to leave this yard on the 6th inst. It is supposed that her ultimate trials will include a trip to Madeira and back for the purpose of proving her stability. During the passage observations will be made of her rolling. She is, as might be expected, the subject of a great deal of criticism. It is asserted in some quarters that her great freeboard will considerably take away from her handsome appearance when she is afloat. Good progress is being made on the *Drake*, considering the small number of hands employed upon her. The *Spartiate* does not make very great progress, as so many of her hands have lately been transferred to the Royal yacht. However, when that vessel is out of the way, the energy of the whole of the workmen in the yard will be concentrated on the *Drake*, *Essex*, and *Spartiate*. In the ensuing financial year no new vessels will be assigned to this yard, but No. 5 building slip is to be extended, and the new electric shop completed

The Transport Department.

The attacks which have been made upon the Transport Department recently on account of the various vessels engaged being late in arriving at their destination, or meeting with mishaps before or after they had left English waters, has brought forth in the *Times* and elsewhere several articles in defence of the Admiralty's selection of steamers for the conveyance of troops. In the *Times* a writer asserts that "for military, not for Admiralty, reasons it was considered undesirable to hurry out troops to ports from which they could not be moved under a considerable time. Consequently steamers of moderate but good speed would carry them out quite fast enough; and, as the utilisation of these would be incomparably cheaper than that of the very fast vessels, it would have been an unpardonable waste of public money not to engage the former! If this is the case, then a good deal of the blame which has been given to the Transport Department should be shifted to the War Office. A letter also appears in the same paper in which it is attempted to prove that the *Zibenghla* and *Zayathla* were only a day or so longer in reaching the Cape than other transports, but the statement the writer appends to his letter showing the passages of transports from the United Kingdom to Capetown only gives the time these two vessels took from the date of their finally leaving British waters. Of course, the real times are from when the *Zayathla* left the Mersey on September 27th, and arrived at Capetown on October 26th, and from when the *Zibenghla* started on October 2nd. It is true that when the two vessels in question were chartered we were not at war with the Transvaal Republic, but it must have been well known that there was certain to be fighting, and therefore somebody will have to explain why fast, reliable steamers were not chartered. That the artillery which the *Zibenghla* and *Zayathla* carried was badly needed at the front has been proved by the fact that it was found necessary to make use of warships' guns for land service.

IMPROVED SHIPS' LAMPS.

THE increased average speed of steamships in all weathers the last few years necessitates the utmost care being exercised in the navigation of vessels.

This requires not only that the ship be skilfully manœuvred by its captain and officers, but also that passing ships receive timely warning, especially during night-time, of the approach of others, and be able to distinguish, without any doubt or hesitation, approximately on what course they are steering.

It will be unnecessary to go into details of the various regulations, except to mention that a green and a red light are placed on the starboard and port sides respectively, of every steamer when under way, besides a masthead light which is of clear glass.

Further, various distinguishing lights are used to indicate whether a ship is disabled, laying cables, at anchor, &c., which it would be beyond the limits of this article to describe.

Granting the necessity of being able to distinguish the lights at as great a distance as possible, it becomes necessary to see in what direction this result can be obtained.

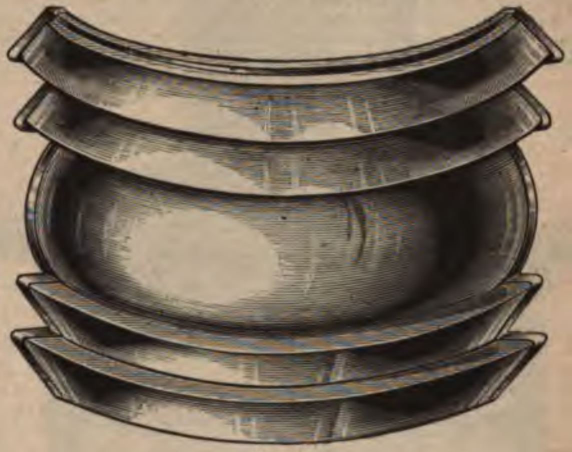


Fig. 1.

Up to the present time most care has been bestowed upon the lamps; this, however, is not nearly so important to-day, as practically every important steamer is fitted with electric light, and its various lights are connected to the mains, and only oil-lamps used as a stand-by.

The other only method of improving the light is by using the most perfect lenses. Here there is room for vast improvement.

The following statement about lenses is made by the Board of Trade in its instructions as to the survey of lights and fog-signals :—

"The lenses should be made of crown glass, highly polished, and free from air-bubbles or other visible defects."

This very clearly points out that the Board of Trade recognise the necessity for the highest class of lenses.

In spite of this request, practically all the lenses used are made of moulded glass in one piece, and can, therefore, only be approximately accurate. Such lenses waste a great amount of light, and also diffuse a large percentage of the light in the wrong direction so that, for example, the screens of the side lights cut off more than is desirable.

To meet a want in this direction, Messrs. Estler Brothers, 27, Leadenhall Street, E.C., are introducing built-up dioptric lenses, in which each portion or lens is accurately ground from an optical point of view, and highly polished.

The various parts have each the correct prismatic shape to diverge the light to the required angle, and, at the same time, absorb an irreducible minimum.

These lenses are naturally more expensive than the inferior moulded article, but when one considers the small proportion of the cost of a set, or even two sets, of lamps in comparison to the remaining outfit of a ship, and when, during the night-time, especially in hazy weather, the safety of a valuable ship depends, to a great extent, on its lights, it must be obvious that none but the very best should be used.

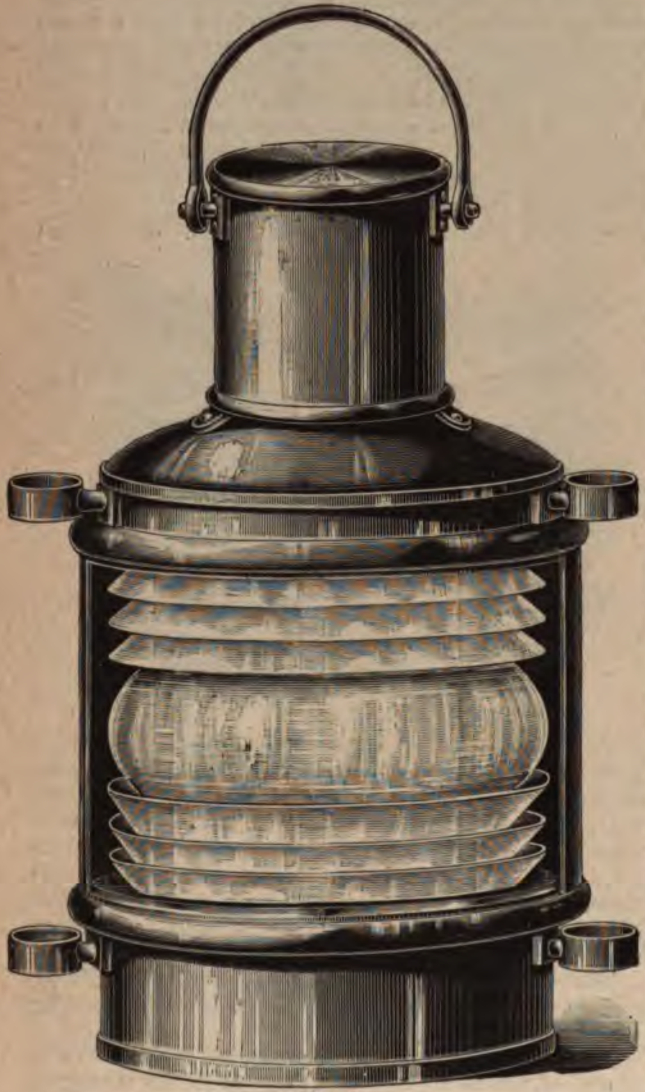


Fig. 2.

The illustrations show the general features. Fig. 1 shows a side-light lens. It will be noticed that it is built up of five parts—the centre-curved lens and the prismatic strips, two above and two below. The various lenses are cemented into a neatly finished brass frame, so that there is no possibility of displacement between the various parts. Fig. 2 shows a masthead light complete as arranged for oil. The lanterns are, as usual in the best class of work, made of copper, and can be fitted for either electric light or oil. Fig. 3 illustrates the various lenses in section with three, five, and six elements. They are made in various other sizes to meet every possible requirement.

In conclusion, we may remark there is very little doubt but that important steamship companies will recognise the necessity of adopting the best quality of glass and accurate lenses for their signal lights.

MARINE ENGINEERS' NOTES.

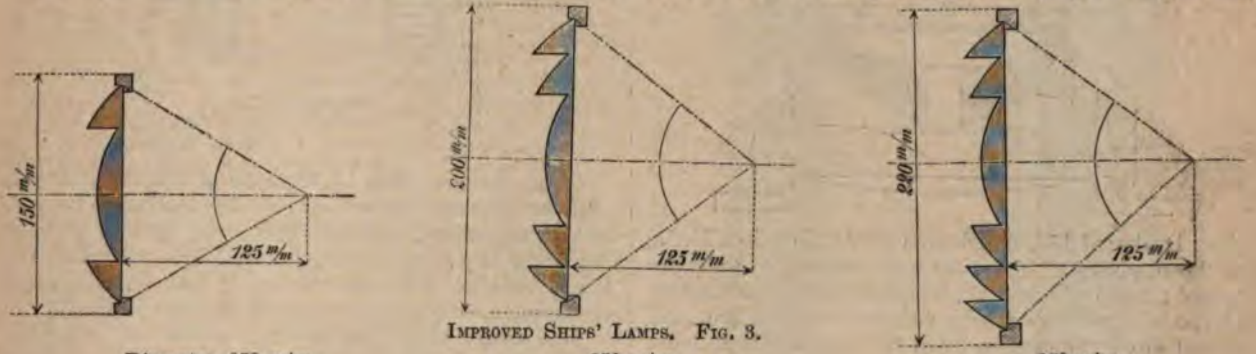
(From our own Correspondent.)

A MEETING of members of the Institute of Marine Engineers took place at their premises, 58, Romford Road, Stratford, Mr. W. Lawrie in the chair. The paper under discussion was that of Mr. Houfe on "Objectionable matter which tends to enter steam boilers and its prevention from so doing." Mr. Lawrie thought the title of the paper would include incrustaton as well as boiler deposits, but this the author had not included as objectionable matter, and so it would be best to confine their attention to the exclusion from the boiler of grease and dirt. One user of filters had already said that they were a failure. Mr. Railton, a maker, gave his experience in writing. He had made them for six years, and he thought the ready method of cleansing the filters had proved very valuable. He found that it was better to place the filter on the discharge side than on the suction side of the pumps—as it is free then from pulsation, which is very bad for the filter. It is the large area on the discharge side of the pump which gives it an advantage. The *Oceanic* and *Deutschland* have been fitted with filters on the discharge side. The former have a filtering area of 30,000 square inches, whilst the area of the latter is 32,000 square inches. Mr. Girvin thought the filters intercepted a great deal of foreign matter. The chairman said Mr. Houfe advocated a separating tank. When he was at sea they had on one of their steamers a condenser for supplying water to cattle, and had to run it from 15 to 20 hours a day. In the evening they filled all the barrels with feed-water for the cattle, and there was neither oil on the top nor deposit in the barrels. Mr. Houfe put his filter on the suction side of the pump, but the maker said ten times as many media were required on that side of the pump. He thought carbonic acid an active force in the corrosion of boilers. Mr. James Adamson said some had adopted the plan of running up the density of the water when they found grease in the boiler.

The dinner of the institute took place at the Holborn Restaurant on the 15th ult. The president, Sir James Lyle Mackay, occupied the chair, and he was supported by Sir Thomas Sutherland, Mr. Duncan Mackinnon, Sir Marcus Samuel, Sir Fortescue Flannery, Sir Walter Pearce, Dr. John Inglis, and others. About 230 were present. Sir Thomas Sutherland proposed "The Navy, Army, and Reserve Forces." He said never since the days of the Crimean War have our Army, our Navy, and our Volunteer forces been engaged in a struggle with a European foe—a foe as brave and determined as we ourselves. Great Britain has entered into this great struggle inspired by the determination that in South Africa there shall be liberty and equality for Englishmen and for all white races alike, under the supremacy of the British Government, which supremacy is essential to the maintenance of our empire. The regiments engaged in Africa, or many of them, bear upon their colours the names of victories achieved in the Peninsular War, in the Crimea, and on the plains and hills of India, but before this struggle is over they will also bear upon those colours the names of victories as great as any of those which have gone before—victories won in contest with men as gallant as they are themselves. For those who have fallen surely no better requiem can be said of them than in the words we know so well—

> "Not once, or twice, in our fair island-story,
> The path of duty was the way to glory."

Admiral Rolfe responded for the Navy, and said it had been the consternation of the Continent to see how a large army corps could be transported to the scene of operations, whilst the generosity of the shipowners and the manner in which they had worked with the Government were marvellous. The ladies of the United States had furnished a vessel for use as a hospital ship, and there was an important American merchant company, the Atlantic Transport Line Co., the chairman of which, Mr. Bernard Baker, had actually given us free a magnificent vessel, most suitable for the purpose of carrying our wounded and taking care of our sick. Messrs. Fletcher & Co. had docked and painted this ship free of expense. Forty years ago Captain Peel took the Naval Brigade with its heavy guns out of the *Shannon* into Central India during the Mutiny. The men of the Navy were doing like good work in the Transvaal to-day. Captain Scott took the guns out of his ship, and arranged the whole thing so satisfactorily that these heavy guns were in Ladysmith, a distance of 200 miles, without anybody in this country being aware of it until they were in action. Lieutenant-Colonel Pritchard responded for the Army, and said our innings in South Africa had not yet commenced, but soon would. The batting on the side of the Boers had been very weak, and he thought that when our men went to the wicket they would surprise the enemy. Colonel Denny responded for the Reserve Forces. He replied also for those volunteers who were now fighting side by side with the regular soldiers and bringing no shame on the name. He was replying for the men from Canada, from Australia, and elsewhere. He was replying for the lion's cubs, who were coming to help the lion.



IMPROVED SHIPS' LAMPS. FIG. 3.

Diameter, 250 m/m.
Height, 150 m/m.

250 m/m.
200 m/m.

250 m/m.
220 m/m.

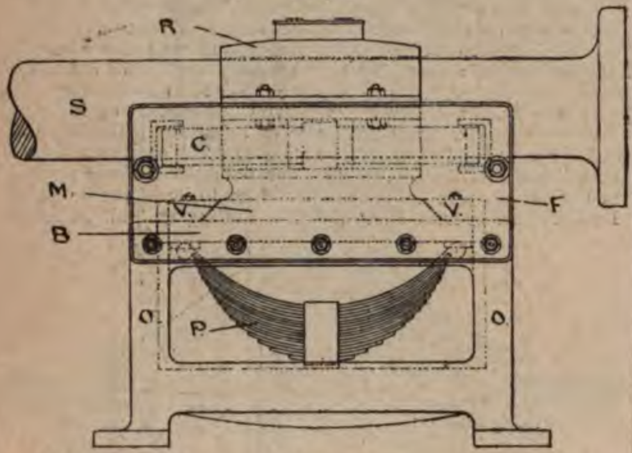
The speech of the evening was that of the President, who proposed "Success to the Institute of Marine Engineers." He said: It would ill become him to attempt to deliver an address to the present audience on abstruse technical subjects. He was a believer in the adage, "the cobbler to his last," and he was sure they would not thank him for making an effort to explain to them how they could obtain an increase of H.P. from a certain engine by reducing the pitch of the propeller or by making an alteration in the throttle valve. He would not give his views on the relative merits of compound, triple and quadruple expansion engines, or instruct them how to repair a slide valve, join together a propeller shaft in event of either giving way at sea, or how to ascertain the density of the water in their boilers in the case of the salinometer becoming disabled. The Institute of Marine Engineers had had a marvellous record of success. Started ten years ago with some 50 members, it had now a list of fully 1,000. Its income last year was £981, and expenditure £914, a state of affairs financially which would have gladdened the heart of Mr. Micawber. The main objects of the association of marine engineers are to promote the science and practice of marine engineering, to facilitate the exchange of ideas respecting improvements in machinery, and to afford facilities for education and self-culture amongst marine engineers with the view to improving their status and that of their profession. The institute had secured a great measure of success, as was shown by its annual records, and that it had the sympathy of scientific, practical, and business men was demonstrated by the list of its past presidents. In a few months' time the nation would be offering a welcome to the returning victors and heaping upon them honours, decorations, and rewards, which they had so well earned. They would have done their duty. The lot of the marine engineer did not involve them in fighting the enemies of their country, but they had daily and nightly battles to fight, going not only down to the sea in ships but down into the engine-rooms, the stokeholds, and the tunnels of these ships. The vessel might be running into danger of which the sharp, unexpected ring of the telegraph in the middle of the watch was to be the first announcement, but their place was on the starting platform in ignorance of what was taking place on deck, and there they remained till summoned from above or driven from below. Deeds of unrecorded heroism occur in British ships every week of the year: danger and death are calmly faced, and full share of these falls to those whose duty lies in the engine-room. A society such as theirs could not but have an influence for good upon its members, and if he might with all humility venture to make a suggestion it would be that they should take steps to record and recognise in some way amongst themselves conspicuous instances of bravery and resource on the part of marine engineers. Sir Fortescue Flannery proposed "Kindred Societies." When the institution was founded 10 years ago there was no feeling of rivalry towards other then existing institutions having similar objects. It was felt that there was a sphere of scientific usefulness hitherto unoccupied by any institution, and that good service could be rendered by such an institution to a class of men who hitherto had not banded themselves together for purposes of scientific research and good fellowship. The institution had prospered with the fullest sympathy and the assistance of kindred institutions. Dr. Inglis responded on behalf of the Institution of Engineers and Shipbuilders in Scotland, which was founded by Professor Rankine—that great mathematician whose power, had he lived, would have enabled him to wrest the whole of Nature's secrets from her. Subjects dealing with all branches of engineering were discussed, and these discussions seldom lacked animation. They did not entertain a feeling of jealousy, and the proceedings of the Institute of Marine Engineers were followed with keen interest. Mr. J. T. Milton responded for the Institution of Civil Engineers and the Naval Architects. The latter body, he said, always welcomed amongst its members marine engineers. Mr. Boyle proposed "The Visitors." Commander Colwell, of the United States Navy, who responded, said that in the inception of marine engineering, and in its progress the Anglo-Saxon had taken the lead. The first steam-engine applied practically to marine propulsion was made by a Scotchman on the Clyde in 1802. The first steam man-of-war was built in New York in 1814. She was made to fight the British. Eventually she blew up. She was a remarkable ship and contained submarine guns to fire 100-lb. shells. It was in the recollection of most present when a marine engine weighed 5 cwt. per I.H.P., and burnt in rectangular boilers 5 lbs. of coal per hour per I.H.P. They could now put 8,000 to 10,000 H.P. engines into a destroyer of 400 tons, which used less than 1½ lb. of coal per I.H.P. per hour. In the naval service of his country they were all trained as engineers. As gunnery instructor, he had under his control more engines and more H.P. than the chief engineer of the ship. He had control of all the engines with the exception of the propelling engines. By the laws of the United States every naval officer must also be a marine engineer. We had heard a good deal during the last few days of what a handy man could do, and the sailor could do it all, but he could not be "an absent-minded beggar." The open door must be maintained by Great Britain and America for all trades.

Alderman Sir Marcus Samuel proposed the heal[illegible] president.

DRAKE'S BEARINGS FOR PROPELLER SHAFTING.

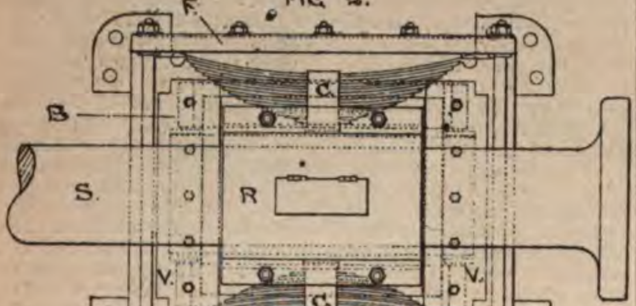
THE difficulties with the propeller shafting of steamships—arising from the bearings being more or less out of line, or the shafting being bent; also from the strains set up by differences of temperature, or from dry docking by placing the vessel on uneven blocks; or from the uneven loading of the cargo causing the vessel to hogg and sagg heavily when exposed to rough weather and heavy seas—are too well known to those interested to need any extensive description from us in the present instance.

Fig. 1



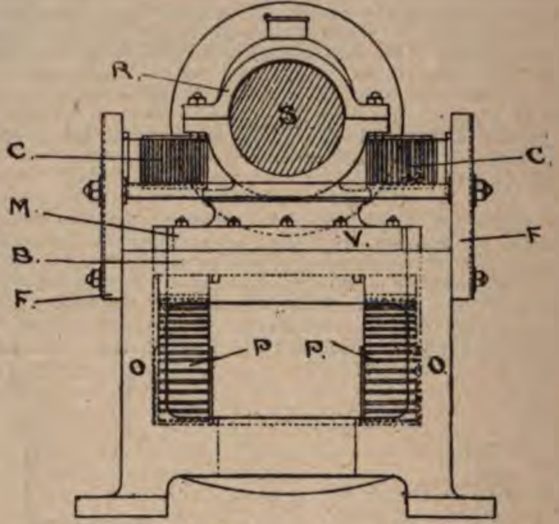
Mr. Drake, of 157, Fenchurch Street, London, E.C., has been giving the matter some attention, and has devised means which shall, within certain limits, allow the shaft to revolve freely, reduce the vibration, and prevent any undue strain upon the engines, couplings, and shafting. The device essentially consists of the employment of bearings supported by springs to replace the rigid bearings now in use, and is illustrated in the adjoining diagrams, of which Fig. 1 is a side elevation, Fig. 2 is a plan, and Fig. 3 is an end elevation. The vertically movable table B is fitted between the columns D, so as to slide, and is supported by the two springs P, the table being left sufficiently clear to allow it to move in an upward and downward direction.

Fig. 2.



The shaft S is supported in a plummer block R, carried by the horizontal thwart-ship sliding table M, and the latter is engaged in grooves V on the vertical table B. Springs C are arranged between the sides of the plummer block R and the frame or columns F, sufficient room being left at the ends of the springs to allow the table M to move athwartships should the vessel be straining in that direction, or in the event of the shaft being bent.

Fig. 3.



It is obvious that by supporting the shaft in this manner its bearings will adjust themselves to its particular alignment, and will follow its motion without throwing any great strain thereon, thus obviating the heavy strains that are set up in the shafting, and removing a very potent cause of fracture in shafts.

We await with interest the result of practical application of this principle of bearing, as it appears to possess very considerable claims to merit for effectively solving a difficult problem, viz., overcoming the serious objections and usual results when the shaft has to support the ship in maintaining its proper form and shape.

ELECTRICAL NOTE.

(From our own Correspondent.)

Electric Motors in the United States Navy.—Rear-Admiral Melville, engineer-in-chief of the United States Navy, has issued his annual report, in which he deals with the electrically driven auxiliary machinery on board ships. The bureau has for a long time been carefully investigating their adaptability to the driving of the numerous auxiliary engines on board ships, and in view of the conclusion that the electric drive of the auxiliaries would not under existing conditions be so satisfactory and economical on the whole as the steam drive, believes it would be of interest to state the reasons for the conclusion. It is commonly believed that, because electric motors are successful on shore, they must be equally successful on board ship. The bureau has planned to use electric motors exclusively in its new plant at the Brooklyn Navy Yard, and it will be readily appreciated, therefore, that their non-use on board ships is for very good reasons. The advantages claimed for electric motors instead of small steam-engines on board ship may be classed as greater ease of operation, avoidance of heat, and much greater economy. Against those, however, are to be put the much greater weight of the necessary electric outfit, the greater delicacy of the type of electric motors ordinarily used, the lack of ready adaptability to the various conditions of the service, a general denial of the claims for economy as ordinarily presented, and the increase in the amount of space required below the protecting deck for the installation of the necessary dynamo-rooms, this space being necessarily taken from the coal bunkers. On board ship, where excess of weight is so carefully guarded against, it would be certainly unwise to adopt a change of motive power, involving a great increase in weight, unless the advantages gained are very material. It must always be remembered that, speaking generally, on board ship the use of an electric motor involves a total weight for the motive power at least three times that of the motor itself, because there are always the generator and its driving engine, besides the motors supplied by them ; that is, the electric drive of an auxiliary will weigh at least three times as much as the steam drive, assuming the motor to weigh no more than the engine it displaces, although usually it does weigh more. It may be objected, however, that the auxiliaries are not all in use at one time, and that, therefore, the generator capacity required is considerably less than the total motor capacity. This is another case where a statement, which may be true elsewhere, is not true on board ship. Naval machinery has to be designed so that in time of action, everything can be ready for use, and, as a matter of fact, a very little study of the question will show that it not only may, but almost certainly would, happen that every auxiliary on the ship, except the capstan engine and some of the boat winches, would be used simultaneously. What has led to the wide use of electric motors on shore are not only the absence of heat, cleanliness, and ease of installation and operation, but above all the simplicity of the transmission of power from a central station to a distance. Now, the great majority of the auxiliaries on board ship are so near the boilers that less piping is involved in a steam drive than in an electric drive from dynamos necessarily at some distance from the boilers. The distance of capstan and steering gear makes electrical drive for them feasible. but it is objected that electricity is not sufficiently reliable for them. A system involving four parts, each liable to break down, is more delicate than one only involving two of these parts. With a steam drive there are the boilers and engines driving the auxiliaries. In the electric drive there are the boilers, the steam engines, also the electric generators and motors. If motors are considered sufficiently reliable to drive feed-pumps and air-pumps on shipboard, for which they are not well adatped, they would be reliable for these other two cases noted which they fit so well otherwise. The absurdity of an electric drive of auxiliary machinery on board ship situated closer to the main engines than the engines driving the dynamos becomes all the more apparent when contrasted with the steam drive for auxiliaries situated in the very extreme ends of the ship. Rear-Admiral Melville takes the case of the *Alabama*. In this the space required for electric motors where used is approximately the same as that required for steam engines to do the same work. The space required for the wiring, etc., is less than that necessary for steam piping had that been used. The space required for the generating sets is 10,140 cubic feet. The capacity of these generating sets is 256 kilowatts, total. If all the auxiliary machinery on board this ship was operated by electricity, and if the space required for the electric generators were increased in the ratio of the increase of necessary capacity in the generating room, the space that would be required would be 50,700 cubic feet for a capacity of 1,200 kilowatts. Consequent upon the extension of the use of electricity would be an increase in the total weight of the machinery equal to from 150 to 250 tons as a minimum. The loss in weight is as much as the gain following the use of water-tube boilers. The increased space occupied by the larger generating room would accommodate 900 tons of coal, or 3,000 H.P. could be added to the power of the propelling engines, giving the ship in the first instance 45 per cent. greater coal endurance, or in the second instance 1·5 knot increase in speed.

The Rankine Patent Feed-water Filter Co., Limited, have taken into partnership Mr. Samuel Cockayne, who was 25 years with the late firm of Siddeley & Co., Liverpool, and for the past seven years partner in the firm of Messrs. E. H. Williamson & Co., engineers, etc., of Liverpool, and have commenced business under the style of Rankine, Cockayne & Co., Limited, as engineers, brassfounders, coppersmiths, etc., at Regent Brass Foundry, 10, Bentinck Street, Liverpool.

THE THERMOSCOPIC LOOP STEAM-TRAP.

IN the adjoining illustration we show two views of the Admiralty pattern of the thermoscopic loop steam-trap. Fig. 1 is a front elevation, and Fig. 2 a side sectional elevation. It will be seen that the construction is of the simplest form. The bottom casting carries internally a tube adapted with a valve at its lower extremity. Around this inner tube an outer tube is arranged, and rigidly supported in the bottom casting. The upper part of the outer tube is provided with a cover carrying two arms, which pivotally support two levers, the free ends of which engage with a groove upon the adjustable screw collar of the upper valve spindle. The levers are pivoted at their central portions to tie rods attached to the bottom casting. The upper valve is adapted to seat upon the upper end of the inner tube. The adjustable screw collar is locked in position when adjusted by the lock nut situated above it on the valve spindle.

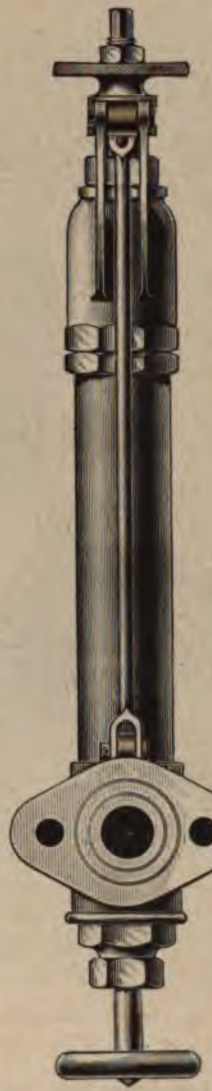


FIG. 1

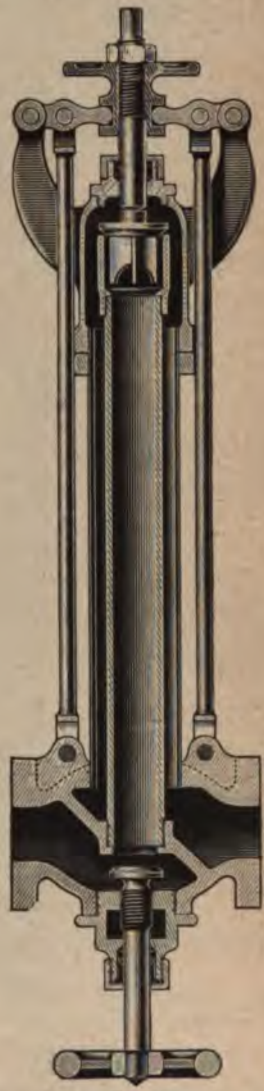


FIG. 2.

Assuming that the trap is properly set, its working s as follows:—As the water collects at the inlet, and the temperature of the inner and outer tubes is reduced, they contract in length and open the valve at the upper end, allowing the water to pass. When the water is nearly all drained away and the temperature is raised the tubes gradually lengthen, and the valve is gradually closed more or less, according to the rate of reduction of temperature. It will be noticed that the inner tube gets hot first, and if the valve does not close quick enough, and allows the hot water or steam to pass the valve, the outer tube is heated and expands, and quickly closes the valve.

To adjust the valve, the valve spindle is held fast by means of a wrench, and the lock nut is slackened back. If the valve is closed it is gradually opened by turning the adjusting screw collar on the spindle until steam appears, when the check nut can be tightened down upon the screw collar, and the trap will then continue to work automatically. This arrangement not only acts as a lock, but prevents the trap being thrown out of adjustment by accident or design, as when locked, the wheel and spindle rotate together.

This device is manufactured and put on the market by F. Lamplough, Rosebery Avenue, London, E.C.

OBITUARY.

MR. THOMAS H. ISMAY.

By the death on the 23rd November of Mr. Thomas H. Ismay after a long and painful illness, which he had combated for upwards of two months, not Liverpool alone, with which part of course he was peculiarly identified, but the whole shipping world loses one of its most prominent and respected representatives. Born in the year at which her Majesty came to the throne, Mr. Ismay had by no means reached old age, and his vigorous presence and cheery voice did not afford his friends any indication of the premature close which was to come to so useful a career. Born and bred in shipping, Mr. Ismay from his Cumberland home found his way to Liverpool, and as a mere boy entered the office of Messrs. Imrie & Tomlinson. On completing his indentures he went for a trip to South America, and on his return entered business on his own account, in conjunction with a son of one of the partners whom he had served. Of the work he has done for the travelling public, and of the mark his career has made on the history of the British mercantile marine, it were too soon to judge. When he, as a man of but 30, took over the famous White Star house flag, it was then borne by sailing ships alone, and was solely known in the Australian trade. Now it may be seen in the Australian trade again, but meanwhile in the North Atlantic, to New Zealand, and across the Pacific, it has extended and consolidated its reputation. Almost immediately upon his acquiring a business of his own he began to lay his plans for extending his operations into the highly competitive New York trade, where steamships of the highest class have always been in keenest rivalry. Some

(From a Photo taken by Alfred Ellis & Walery, 51, Baker Street, London, W.)

The late T. H. ISMAY, Esq., D L., J.P., Founder and Chairman of the White Star Line.

dealings had taken place between the firm of Ismay, Imrie & Co., and Messrs. Harland & Wolff, of Belfast, who had constructed sailing vessels for them. To them therefore Mr. Ismay turned for his pioneer steamship the *Oceanic*, and with them, as we heard the other day when the freedom of the City of Belfast was conferred upon Mr. Ismay, more than seven millions sterling has been expended on building and equipping steamships. All was done without contracts and without friction. That so unique an arrangement should have been practicable says much for both parties to the bargain. The advent of the *Oceanic* introduced comfort and safety to an unprecedented degree into Atlantic travel, and the popularity of the line quickly grew. Eleven steamships in all have been constructed for the mail line, culminating in the gigantic *Oceanic* No. 2, which Mr. Ismay saw launched indeed, but which it was not granted to him to see under steam. Not content with his share of the Atlantic trade, a departure was soon made into Trans-Pacific conveyance, where at present three fine steamers are now on the station. About the year 1881 it was seen that steam was now ready to affect commercial results in the New Zealand trade, and the companies interested then began discarding sailers in favour of steamers. When this point was reached, vessels of the White Star Line were brought in, and the *Arabic* and the *Coptic* were soon joined by the *Ionic* and the *Doric*. The type now affected for this trade is well represented by the twin-screw steamers *Delphic* and *Gothic*. Then vessels were built for the purely cargo trade on the Atlantic. Cotton—always a dangerous thing to carry—was relegated to these boats, and the reassuring announcement made that "cotton is not now carried by the passenger steamers." Beginning with the 4,400 tons *Runic* and her sister (both of the single-screw type) an advance to the twin-screw was made in the next pair. Size was increased in every new steamer, and every possible convenience for the safety and comfort of cattle brought into the fleet. The tiny percentage of losses of cattle by these vessels is the measure of the success which the care bestowed in their outfit and management brought. At the same time safety was studied, and large appliances introduced which might facilitate rapid handling of cargo. At last in the most recent vessel of this class the advisability of introducing a limited number of saloon passengers has been considered, and the experiment has been attended with conspicuous success. Mr. Ismay's last move with regard to his fleet was the inception of the Australian line, for which 60,000 tons of shipping in five splendid twin-screw steamers is being provided. Thus the line can offer a monthly sailing in exactly similar boats to shippers and passengers of the class catered for.

But shipping was not his only interest. The London and North Western Railway has had him for many years on the directorate, and he had the distinction of refusing its chairmanship, as he did the proferred peerage. The substitution of twin-screw passenger steamers for the old-fashioned paddlers in the fleets of the North Western Railway at Holyhead, and in that of the Lancashire and Yorkshire at Fleetwood, was largely due to his influence. To that is also due the immense advantage which Liverpool gained—and that none too soon—from the opening of the Riverside station. He was also on the board of the Royal Insurance Co.

He had much influence, of course, with the Mersey Docks and Harbour Board, of whose audit committee he was chairman. Liverpool and Belfast both had reason to regard him as a benefactor. To Liverpool, where he employed seamen, he gave—and gave handsomely—to the Aged Mariners' Home at Egremont. To Belfast, where he indirectly employed workmen, he gave liberally to the local hospital. To his own people he was generous, too, and much thought was expended for their benefit. Using for them his experience in the assurance world, he was enabled to produce for them a scheme of life assurance whereby the firm assists the officers to provide for themselves. In his more public work his unique position enabled him to do much to keep the North Atlantic Conference together, and it was his influence that caused the important mail lines to adopt the Lane Routes, which had only previously been adhered to by one or two. This has done much for the safety at sea which he considered so much more than mere speed. Various Royal Commissions, &c,.owed much to his services. Amongst these may be instanced the Bulkheads Committee, the Side Lights Committee, the Royal Commission on Labour, Lord Ravensworth's Admiralty Committee on the systems of building vessels for the Royal Navy. He acted as chairman of the Board of Trade Life Saving Appliances Committee, and was on Lord Hartington's (now the Duke of Devonshire) Royal Commission on Army and Navy Administration. At the time of his death he was serving, on the nomination of H.R.H. the Prince of Wales, on the Royal British Commission of the Paris Exhibition, 1900. Everything he touched he worked hard upon, and everywhere he served his tact and weight of character helped to soften asperities and to remove difficulties. His two sons, Mr. J. Bruce Ismay and Mr. James H. Ismay, have been for some years partners in their father's old firm. They are carrying on the policy which he inaugurated, and managing the business he built up with ability and success. The line which Mr. Ismay founded will doubtless continue to prosper, but the disappearance of so stalwart and representative an Englishman of the highest commercial class leaves a blank which will not easily be filled. Of the severity of the loss sustained by his family and friends this is not the place to speak.

MR. EDWARD MACKAY, GREENOCK.

The painfully sudden death occurred on the morning of the 24th ult. of Mr. Edward Mackay, manager of Messrs. Scott & Co.'s foundry, Greenock Mr. Mackay was in his usual health when he left the house, but whilst proceeding along Nelson Street, and when opposite the Eye Infirmary, he suddenly dropped down, and was immediately carried into the institution. Dr. Douglas was sent for, but life was extinct. Death was due to failure of the heart's action.

Deceased, who was a native of Largs, served his apprenticeship with Messrs. Scott & Co., starting in 1854. In 1860 he was sent by that firm to the South of England to look after some work on which they were engaged there. After serving for a time in the drawing office he entered the Glasgow University, where he was one of Professor Rankin's most promising pupils. He was engaged for a time as head draughtsman with Messrs. A. & J. Inglis, Glasgow, which firm he left to go to Sunderland to take up the position of head draughtsman and assistant manager of the North-Eastern Marine Engineering Co. He returned to Messrs. Scott in 1871, and was appointed manager, which position he held till his melancholy death. Mr. Mackay was held in great esteem by his employers, whose entire confidence he retained throughout. He was not much in public life, but gave valuable service in connection with the science classes of the School Board, and was an active member of George Square Congregational Church.

MR. DIXON KEMP.

Mr. Dixon Kemp, an eminent authority on yachts and yachting, passed away on Wednesday morning, November 22nd. In him there was the rare combination of editor and yacht builder. He was born in 1839 at Ryde, and was therefore 60 years of age at the time of his death. For three years—1859-62—he was editor of the *Isle of Wight Observer*, and from that time forward he was yachting editor of the *Field*. He published a number of books relating to yachts and shipping, many of which are now classical, and largely helped to found, and was for many years secretary of, the Yacht Racing Association. He also was largely instrumental in establishing "Lloyd's Yacht Register." He was a member of the Institution of Naval Architects, and was responsible for the design of many of our finest steam and sailing yachts.

HULBURD'S SEAMLESS COPPER JOINTINGS.

ONE of the questions which the modern engineer has often to consider is that of efficiently and readily making joints either of pipes or other connections, and for covers.

The increase in steam pressures of late years has made the necessity of a reliable jointing peculiarly obvious, and considerable attention has been directed to the subject, resulting in new methods being devised and old systems being improved. The Hulburd Engineering Co., of 150, Leadenhall Street, London, have devised and put on the market a system of jointing which, we understand, has been found from actual use to be most reliable and lasting for steam-pipes, cylinder, condenser and boiler-covers, valve-boxes, and domes.

The system of using a copper wire-ring is very old, and has been in common use for 25 years; and, although it made an excellent joint as a general rule, it had two defects, viz.:—Firstly, it offered so small a bearing surface that it did not cover blow-holes of any size, and its thinness of section naturally afforded little life or resilience under the pressure; and, secondly, it had the more important defect that the copper wire had to be soldered at its joint. This created not only a point of weakness, but gave unequal compressibility, which prevented the flanges being made absolutely steamtight, and increased the risk of bending the flanges by the use of excessive pressure.

In the adjoining illustrations we show sections of pipe-joints having Hulburd's seamless copper rings. These jointings are made of specially prepared copper, which allows a series of corrugations with sharp knife-edges to be formed on both sides, so that a very slight pressure upon the surfaces to be jointed makes the joint perfectly tight, and precludes any risk of strain; whilst in the case of very light glands or flanges, specially designed jointings, arranged both outside and inside the bolts, meets the same danger. Fig. 1 shows the ring arranged within a recess on one flange into which a spigot on the other flange enters, thus ensuring the concentricity of the ring with the pipe. Fig. 2 shows an arrangement to avoid unnecessarily increasing the width and weight of the rings in cases where any difficulty is likely to arise in centreing them, by providing a thin white metal disk to their outer edge, fitting exactly against the bolts, in order to ensure concentricity with the pipe.

The advantages which a practically indestructible jointing has over asbestos and similar materials consists not only in the fact that the former will neither char nor blow out, but also in that it can be removed and replaced without the use of tools, for it neither adheres to the flanges nor requires any red lead or other filling. In cases where speedy examination and reconnection has to be provided for, such a jointing appears to be most valuable. That this is so, and that the first cost is amply repaid in the saving of subsequent renewals, and the labour such renewals entail, is reasonably deducible from the fact that the Admiralty and chief naval contractors and railways—as well as private firms, who have even perhaps more than large corporations to compare immediate disbursements with future profits—have, we understand, adopted this system of jointing. The jointings are made in a variety of sections, sizes, and thicknesses, and are turned out with an exactitude which in itself shows how high a value is now put upon the question of jointing, as compared with the time when a rough washer of deleterious material was cut out by rule of thumb, and casually inserted between joints, upon which the very efficiency of an engine must more or less depend. For our part, we agree with those who hold that the best designed machinery may give bad results for want of attention to essential details.

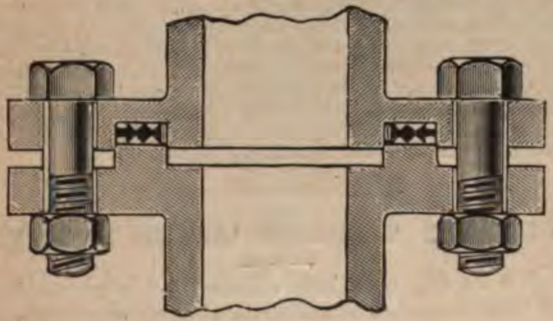


Fig. 1.

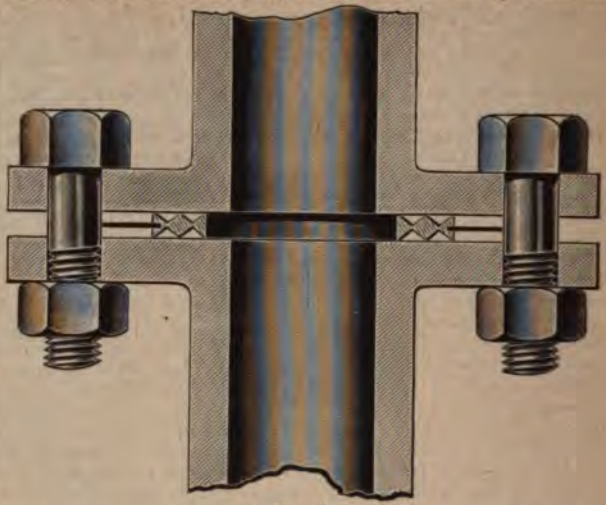


Fig. 2.

The Deighton's Patent Flue and Tube Co., Limited.—We have received a very handsome book from the Deighton's Patent Flue and Tube Co., Limited, which gives not only a description and illustrations of their Vulcan Works, Pepper Road, Hunslet, Leeds, but contains some extremely interesting information with reference to their particular form of patent furnace. Tabulated statements are given as to dimensions, thickness of plate, depth and pitch of corrugations necessary under various pressures. Illustrations and particulars are also given relative to six furnaces which were tested to destruction by the Board of Trade during 1898, which show the various results with various thicknesses of plates and other conditions. The book, although issued as a catalogue, is quite above the average style issued by manufacturers, and does the firm much credit.

Catalogue.—We have just received a very bulky and extensively illustrated catalogue of engineers' and joiners' tools and machinery manufactured and sold by Messrs. C. Nurse & Co., of 182, Walworth Road, S.E.; 144, Bishopsgate Street Without; and 100, Fleet Street, London, E.C. When we mention that it numbers over 300 pages, some idea can be obtained of the immense variety of tools and appliances set out therein. Not only are there some hundreds of illustrations, but the explanatory letter-press adjoining each illustration leaves nothing to be desired by those consulting the catalogue to select tools therefrom. Taking it as a whole, it is one of the most complete catalogues of tools we have ever come across.

The Buoyant Clothing Syndicate, Limited, of 21, Royal Hill, Greenwich, have supplied the American Ladies' Hospital Ship *Maine* with 300 specially made jackets. These jackets are now worn by over 21,000 soldiers and sailors, yachtsmen, ladies, and children, and no single life has been lost, although many wearers have been shipwrecked, and some three times in the same jacket. They are under Imperial, Royal, and most distinguished patronage, including the Royal Humane Society, Marine Engineers' Union, Limited, per Mr. Marshall, secretary, who signed a petition to the Board of Trade two years ago in favour of its adoption in the Merchant Navy—along with 15 M.P.'s, 50 largest shipowners, and 250 captains and officers in active marine service in the Castle Line and Atlantic, and other ocean services. Rear-Admiral Lord Charles Beresford, C.B., M.P., writes through his secretary, Mr. Robin Grey, and says: "I well remember your life jackets, and have no doubt of their excellence." The firm have also been awarded six gold medals, 11 diplomas of honour.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from October 26th to November 25th, 1899:—

Abbott, H., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.
Abbott, H., chief engineer to the *Victory*, for the *Crane*, to date October 9th.
Alexander, J. W. (probationary), assistant engineer to the *Sans Pareil*, to complete complement, to date November 11th.
Allden, F. A., engineer, has been promoted to the rank of chief engineer, with seniority of October 1st.
Allden, F. A., chief engineer to the *Tauranga*, reappointed on promotion, to date October 1st.
Allen, A. E. (probationary), assistant engineer to the *Revenge*, to date November 23rd.
Archard, E. A., assistant engineer (temporary) to the *Vulcan*, to date November 23rd.
Attwood, F. M. (probationary), assistant engineer to the *Juno*, to date October 31st.
Barker, H. C. D., assistant engineer to the *Sans Pareil*, to complete complement, to date November 11th.
Barry, G. W., fleet engineer to the *Revenge*, additional, and for recommissioning, to date November 23rd.
Bath, G. C., chief engineer to the *Cambrian*, to date October 31st.
Black, W. J., staff engineer to the *St. George*, to date October 31st.
Brown, H. A. (probationary), assistant engineer to the *Arrogant*, to date November 11th.
Burner, W. H., fleet engineer to the *Duke of Wellington*, for the *Raleigh*, to date October 31st.
Chope, W. D., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.
Chope, W. D., chief engineer to the *Barracouta*, to date November 2nd.
Codrington, C. A. (probationary), assistant engineer to the *St. George*, to date October 31st.
Cook, L. J., assistant engineer to the *Wildfire*, for the *Edinburgh*, to date November 1st.
Dalrymple, J. H., chief engineer to the *Vivid*, for the *Blonde*, on paying off, to date the day after paying off.
Dathan, W. A., engineer to the *Victoria and Albert*, to date November 9th.
Davis, F. C., engineer to the *Duke of Wellington*, for the *Brazen*, to date October 25th.
Downer, J. M., staff engineer, to be lent for transport duties in the Thames district, to date November 1st.
Everett, A. E., engineer to the *St. George*, to date October 31st.
Ferguson, S. P., engineer to the *Juno*, to date October 31st.
Garde, R. B., engineer to the *Pembroke*, for the *Angler*, to date November 7th.
Gay, G. M., assistant engineer (temporary) to the *St. George*, to date October 31st.
Goldsmith, H. C., fleet engineer to the *Excellent*, for the *Hero*, and for supervision of machinery of gunboat tenders to the *Excellent*, to date November 16th.
Goodwin, G. G., staff engineer, has been promoted to the rank of fleet engineer, with seniority of October 25th.
Goodwin, G. G., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.
Gregg, C. J., engineer to the *Minerva*, to date October 31st.
Groves, E. (probationary), assistant engineer to the *Minerva*, to date October 31st.
Gurnell, T. (probationary), assistant engineer to the *Canopus*, to date December 5th.
Hall, W. B., acting engineer to the *Pembroke*, for the *Shearwater*, to date October 31st.
Hamilton, G. J. K., assistant engineer (temporary) to the *Vulcan*, to date November 23rd.
Hardcastle, S. U., assistant engineer to the *Collingwood* (temporary), to date November 1st.
Hawkins, H., fleet engineer to the *Canopus*, to date December 5th.
Hender, W. J., chief engineer to the *Bellona*, on commissioning, undated.
Heyes, H. W., engineer to the *Pembroke*, for the *Coquette*, in lieu of a chief engineer, to date November 1st.
Hicks, J. A. H., staff engineer to the *Wildfire*, for the *Edinburgh*, on commissioning, to date November 1st.
Hudson, G. W., staff engineer to the *Rupert*, to date November 23rd.
Hughes, T. E. (probationary), assistant engineer to the *Cambrian*, to date October 31st.
Hunter, R. A., engineer to the *Revenge*, undated.
Ireland, J. H. H., engineer to the *Victoria and Albert*, to date November 9th.
Jeffery, R. G., assistant engineer to the *Trafalgar*, to complete complement, to date November 11th.
Lilburn, T. E. F., assistant engineer (probationary) to the *Revenge*, to date November 23rd.
Maltby, P. D., engineer to the *Canopus*, to date December 5th.
Mathew, G. W. (probationary), assistant engineer to the *Trafalgar*, to complete complement, to date November 11th.
Miller, M. R., fleet engineer to the *Duke of Wellington*, for the *Iris*, to date November 23rd.
Minhinnick, P. C., assistant engineer to the *Canopus*, to date December 5th.
Moffett, E. G. P., staff engineer to the *Pembroke*, for the *Champion*, to date October 31st.
Moore, A. J. C., assistant engineer (probationary) to the *Revenge*, to date November 23rd.
Morgan, T. J., acting engineer, has been confirmed as engineer in her Majesty's fleet.
Morison, R. B., engineer to the *Europa*, to date November 23rd.
Morley, H. S., assistant engineer (temporary) to the *Revenge*, to date November 23rd.
Moysey, A. H., engineer to the *Pembroke*, for the *Swordfish*, to date November 7th.
O'Dogherty, F. B., assistant engineer to the *Howe*, to complete complement, to date November 11th.
Pill, J. H., staff engineer to the *Minerva*, to date October 31st.
Purkis, J. T., fleet engineer to the *Europa*, when commissioned, to date November 23rd.
Radford, H. G., assistant engineer (temporary), to the *Canopus*, to date December 5th.
Risch, C. L. J. (probationary), assistant engineer to the *Canopus*, to date December 5th.
Ross, G. J., fleet engineer, has been placed on the Retired List at his own request.
Rundle, M., engineer to the *Victoria and Albert*, to date November 9th.
Russell, H. F. (probationary), assistant engineer to the *Vivid*, for the *Albion*, to date November 11th.
Ryan, J., staff engineer to the *Vivid*, for the *Forth*, to date November 23rd.
Ryan, W., engineer, has been promoted to the rank of chief engineer in her Majesty's fleet.
Ryan, W., chief engineer to the *Beagle*, to date November 1st.
Salter, A. G. V., engineer to the *Vivid*, for the *Albion*, to date November 11th.
Sanders, W. C., engineer to the *Renown*, for the *Ardent*, in lieu of a chief engineer, to date November 1st.
Shattock, T., engineer to the *Cambrian*, to date October 31st.
Short, E. A., chief engineer to the *Sharpshooter*, to date October 31st.
Start, S. P. (probationary), assistant engineer to the *Howe*, to complete complement, to date November 11th.
Underhill, C., fleet engineer to the *Vivid*, for the *Volage*, to date October 31st.
Underhill, C., fleet engineer to the *Boscawen*, for the *Agincourt*, to date November 23rd.
Vinning, C. E., assistant engineer (temporary), to the *Rodney*, to date November 23rd.
Weeks, C. M. (probationary), assistant engineer to the *Australia*, to complete complement, to date November 11th.
Whebby, T., fleet engineer to the *Vivid*, for the *Cleopatra*, to date October 31st.
White, G., fleet engineer to the *Alexandra*, to date November 16th
White, W. W., fleet engineer to the *Juno*, to date October 31st.
Wormald, G., acting engineer, to be lent to the Admiralty for temporary duty, to date October 26th.
Wormald, G., acting engineer, has been confirmed as engineer in her Majesty's fleet.

The Russian Ministry of Ways of Communications is now building a dry dock at the port of Archangel, and has consented to allow it to be made use of by cargo steamers.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

CLYDE shipyard and engine-shop operations during November—or as much of it as is past at date of writing, 24th ult.—have been carried on with accustomed briskness, and a further considerable contribution has been made to the aggregate of the years' output, which, when fully told, will form by far the greatest figure on record.

The Governmental chartering of so many of our best mercantile steamers to take troops and munitions of war to South Africa is having its effect, not only in creating a demand for the tonnage that is available, but in making shipowners spur on the completion of vessels on the stocks. In this way shipbuilders are found in the several districts advertising and beating-up for additional "hands"—particularly riveters. A Leith firm, for example, by no means amongst the largest of the shipbuilding concerns in Scotland, are advertising for—and offering every encouragement in the way of constant employment—as many as 12 squads of "steady ship riveters." From the monthly report of the Boilermakers' and Iron and Steel Shipbuilders' Society, indeed, it is gathered that no fewer than 150 full squads of riveters are urgently wanted for shipyards in the various districts.

This great demand emphasises what has long been felt by shipbuilding employers, that the agreement as to limitation of apprentices, which has obtained for a considerable period, has operated most effectually in depleting the ranks of the riveters, and rendering such labour very scarce indeed. The agreement, however, has now run its course, and the employers are not likely to renew it. It is believed, on the contrary, that they will take the opportunity thus afforded them to raise the whole question of the "control of the workshops," as was done in the case of the engineers. With the unsteadiness and flagrant loss of time on the part of too many of their workmen, the employers are quite in a temper at the moment to see such a policy through to a finish.

The new contracts booked during November have not been very numerous, but several rather substantial orders are included, references to which will be made in the course of these notes. There are further inquiries in the market for steamers, and the demand for steel is very strong. Steel plates and angles are higher in price than they have been for many years, and makers can practically dictate their own terms, as they have well-filled order books which will keep them busily employed for a very long time. The result of high-priced materials and continued briskness in the yards and shops is, of course, dear ships and engines, and the orders which have been placed, it may be taken as assured, are for vessels very much required.

Apart from the Press Agency cables from "the other side" conveying the momentous announcement, nothing whatever has been heard on the Clyde of the two great steamships which a shipbuilding firm there is reported to have been instructed to build by the Great Northern Railway of America through its president, Mr. J. J. Hill. The vessels, which are said to be intended for plying regularly between Seattle and Japan, are both to be larger than the *Oceanic*, and each to have a capacity of 20,000 tons. "They are to be completed," says the cable, "by the year 1901." Meantime, it would appear the Clyde firm referred to are keeping these rivals of the big *Oceanic* up their sleeve!

Messrs. Charles Connell & Co., of Scotstoun, have been commissioned to build two large steamers of from 5,000 to 6,000 tons—one, if not both, being for the City Line of steamers, managed by Messrs. George Smith & Sons, the senior partner of which firm died on the 2nd ult. The engines for these vessels will be supplied by Messrs. Dunsmuir & Jackson, Govan, whose shops are, and have for some considerable time been, very fully taxed with work.

Messrs. John Shearer & Son, of Kelvinhaugh Shipyard, who have during the past six weeks or so been exceptionally well-occupied effecting the necessary alterations on the internal arrangements of steamers chartered by the Government as transports, are about to lay down the keels of two vessels of moderate size for coasting purposes, to the order of a Glasgow firm.

The latest addition to the Navy from Clyde shipyards is the new cruiser *Hyacinth*, which has now completed her official trials. This vessel has been built and engined by the London and Glasgow Shipbuilding and Engineering Co., Limited, and is the third sent from their works this year for the British Navy. Indeed, this firm, since Mr. J. W. Shepherd became the managing director, has taken quite a prominent place amongst naval shipbuilders, for the *Hyacinth* is the eighth vessel delivered to the Navy by the company. The displacement of these aggregated 70,000 tons, whilst the machinery represents 59,000 I.H.P., and all of this machinery has been designed and successfully passed through trial by Mr. William Morison, the engineering manager. The *Hyacinth* is a vessel of 5,600 tons, and resembles the *Hermes* and *Highflyer* constructed at Fairfield. The former has already gone off to South Africa to add to our naval strength there in view of the war.

Messrs. John Brown & Co., Limited, of Sheffield, launched on Saturday, the 18th, from their recently acquired establishment at Clydebank her Majesty's ship *Sutlej*, the first to be floated of the four armoured cruisers of the *Cressy* class, the orders for which were placed on the Clyde. The *Bacchante*, which is on the stocks at Clydebank, the *Cressy*, and the *Aboukir* at Fairfield, and the *Hogue* and the *Euryalus* at Barrow are sister ships. The vessels are 12,000 tons displacement, and their speed is to be 21 knots with the engines indicating 21,000 H.P., while steam will be supplied in each case by 30 Belleville boilers fitted with economisers. All the berths in Messrs. John Brown and Co.'s yard are full, as the British warship *Leviathan* is to be laid down in the place vacated on Saturday by the *Sutlej* The Japanese battleship *Asahi*—which will be ready about April—is in the dock with the *Sutlej*. On the stocks are the armoured cruiser *Bacchante*, three destroyers, four American liners, the Cunarder *Saxonia*, and two fast steamers for the London and South-Western Railway Co. The *Saxonia*, which is in essential respects a sister ship to the *Invernia*, launched from the shipyard of Messrs. Swan & Hunter on the Tyne in September last, will be launched before the close of the year, thus swelling the year's output of the Clydebank establishment by 14,000 tons. Like the *Invernia* the Clyde-built vessel is 580 ft. long (over all, 600 ft.), 64 ft. 6 in. beam, and 41 ft. 6 in. deep to upper deck. The wet dock adjoining the shipyard is now occupied, as above stated, by the *Sutlej* and by the Japanese battleship *Asahi*, 15,200 tons displacement. The latter is not expected to be ready for her steam trials before April next year. A statement which has been going the rounds to the effect that work on this vessel has been accelerated at the request of the Japanese Government is inaccurate. There has been no communication on the subject, and the completion of the vessel at Clydebank is proceeding as usual. The torpedo-boat destroyer *Electra* left the wet dock of the Clydebank Co. on the 15th of the month for Portsmouth to undergo her final trials preparatory to being taken over by the Government. Two other Clydebank-built destroyers will be leaving shortly for the same purpose.

From the 20th to the 22nd of the month, the subscription list was open for an issue of preference shares in Messrs. John Brown & Co., Limited, for the purpose of providing the remainder of the additional capital required for the purchase of the works and business of the Clydebank Engineering and Shipbuilding Co., Limited. The business has been carried on since the 31st March last on behalf of John Brown & Co., and a considerable part of the purchase-money has since been paid. The company took possession of the shipyard and other properties on the 2nd September last, since which date the business has been carried on by them. The Clydebank Works, the prospectus states, consist of the shipyard, engine works, boiler shops, and auxiliary departments, all of modern construction, fitted throughout with the latest appliances for efficiently turning out battleships and other war vessels, mail steamers, and cargo boats of the highest class. Over £280,000 have been spent on new machinery and other important extensions during the past four years. There are uncompleted contracts on the books for over £3,000,000, including three first-class cruisers for the Admiralty, the Japanese battleship *Asahi*, and five large Atlantic liners, which are progressing satisfactorily, and are considered sufficient to keep the works fully occupied at profitable prices for about two years.

Mr. J. G. Dunlop, who has for many years been actively connected with the management of the Clydebank business, has been appointed manager of the shipyard for a term of five years from April 1st, 1899; and on the 26th September, at a general meeting of the shareholders, he was elected a director of the Company.

Messrs. Bow, McLachlan & Co., Thistle Works, Paisley, who continue extremely busy with orders for their patent steering gears, hoists, and other specialities—many of which are for naval ships now being built in the dockyards and private establishments—have also on hand in the yard of Messrs. McArthur & Co., which they themselves carry on, three powerful tug steamers for the Admiralty. The vessels are 170 ft. in length, and are to be propelled by twin screws.

Messrs. William Simons & Co., Limited, Renfrew, launched from their yard on the 23rd ult., what is believed to be the most powerful barge-loading dredger ever built. This vessel, named the *Devolant*, has been constructed to the order of the Russian Government, and is intended to work at one of the ports on the Black Sea. The vessel is 182 ft. in length, 36 ft. broad, and 13 ft. deep. The buckets are exceptionally large, having each a capacity of 35 cubic feet. Dredging can be done to a depth of 36 ft. below water-level, and the lifting capacity of the vessel is 1,890 tons per hour. For propulsion the vessel has a set of compound surface-condensing engines, supplied from two cylindrical boilers of 120 lbs. working pressure. For regulating the cut of the dredger, powerful winches are fitted at the bow and stern. The dredger was launched with engines, boilers, dredging gear (including buckets), &c., fitted complete on board and ready for work, and will in a few days, after trials, proceed to the Black Sea.

Messrs. Simons & Co. have at present under construction, to the order of the Suez Canal Co., for the dredging of the Port Said roads, the largest stern-well bucket hopper dredger in the world, having a hopper capacity of over 2,100 tons of dredgings. The vessel is 266 ft. long between perpendiculars, 47 ft. breadth, moulded, and 19 ft. deep. She will dredge to a depth of 39 ft. 4 in., and will have a lifting capacity of 1,800 tons per hour, the buckets each having a capacity of 30 cubic feet. For propelling the vessel there will be two pairs of triple-expansion engines—either set of engines being capable of driving the dredging gear—supplied from two steel multitubular boilers of 160 lbs. working pressure. The hopper of this immense dredger will be one large apartment, placed amidships, and the hopper doors will be worked entirely from one position by one man.

Messrs. Fleming & Ferguson, Limited, Paisley, launched, on the 23rd ult., into the River Cart the new vehicular four-screw ferry steamer, with elevating platform, which they have for some time had under construction for the Clyde Trustees. The new vessel, which is in all essential respects similar to the vehicular ferry *Finnieston*, built in 1890 by Messrs. William Simons & Co., Renfrew, from designs patented by them a number of years previously, will eventually occupy the station at present—and since 1890—served by the *Finnieston*; and the latter vessel will be transferred to a new cross-river station further down the harbour, and be renamed. The large deep-water recesses on each side of the river—Whiteinch on the north and Linthouse on the south—for the reception of the vessel at the end of each passage are now almost entirely constructed, and the two steamers, old and new, ought to be on their respective stations and contributing materially to the cross-river facilities before the New Year.

Messrs. Russell & Co., of Port-Glasgow, have been busily employed for some considerable time past executing orders received from French shipbuilders for masts, spars, and other equipment destined to form part of sailing ships in course of construction in French yards; and now it is intimated that not only the masts and spars but the actual hulls of sailing vessels are to be prepared and shipped in pieces for reconstruction and completion on French soil. According to reports an order for six sailing vessels has been entrusted to Messrs. Russell, the hulls to be prepared and built on the Clyde, and afterwards taken to pieces, shipped to France, and there re-erected. We are enabled to state that these reports are in part well founded. The structural material for at least three vessels has been ordered and prepared on the Clyde, according to plans, and despatched to France for erection and completion.

Messrs. Blackwood & Gordon, Port-Glasgow, have been commissioned by the Mersey Dock and Harbour Board to build and engine the hull of a floating crane for harbour and river service. The hull will be about 160 ft. long, and will have engines for its propulsion, as well as for operating a jib-crane of 50 tons capacity and considerable outreach. The crane itself is to be supplied by Messrs. Russell & Co., Motherwell, several of whose appliances are now in use at Liverpool and giving satisfaction, notably the hydraulic travelling jib crane alongside the New Canada Graving Dock. The Mersey Harbour and Dock Board, it may be of interest to add, have within the last few years spent enormously in connection with the improvement of the Mersey and the port and docks of Liverpool, their bill for dredgers and such-like craft and apparatus to one Clyde firm alone, including the contracts presently on hand, amounting to over £150,000.

Early in the month an interesting trial trip took place on the Firth of Forth, this being the oil fuel trial of the tank steamer *Syrian*, built by the Grangemouth Dockyard Co., engined by Messrs. Hutson & Sons, Kelvinhaugh, Glasgow, for the carriage of petroleum in bulk for Eastern trade. In the previous week the coal trials were very successful, the speed obtained being nearly a knot in excess of the guarantee. The result obtained from the oil fuel was still more satisfactory. The oil used was that technically called astatki. On running the measured distance the speed was 11½ knots, or nearly a knot more than was the case with the Scotch coal. The number of revolutions was seven to eight more per minute and the H.P. 200 more than at the coal trial, whilst the steam pressure of 180 lbs. was obtained with ease, notwithstanding that all the auxiliary machinery was running the whole time. The consumption of oil at the trial was found to be 25 per cent. less per H.P. than the consumption of the coal. A number of experts, besides representatives of the owners, were present, and expressed themselves as highly satisfied with the successful results obtained, and predicted a bright future for this fuel for marine purposes. It is intended in the case of the sister ship now fitting out by the same builders to ship sufficient oil fuel to take her to her destination in the East. When on their regular services both vessels will use oil fuel exclusively.

Messrs. Hutson & Sons, of Kelvinhaugh Engine Works, Glasgow, have, in addition to the engines and boilers for the second of the two oil-burning vessels above referred to, a great amount of work on hand, chiefly for such shipbuilding firms as the Grangemouth Dockyard Co., the Campbeltown Shipbuilding Co., Messrs. McKnight & Co., Ayr, etc. In their boiler works at present some very interesting contracts are on hand in the way of "haystack" type of boilers for river and channel passenger steamers. This form of boiler, though not so much in use as it once was for river steamers, is still preferred by many engineers and shipowners, as affording high efficiency with small weight—especially in the case of the boilers now being made for high pressure. Messrs. A. & J. Inglis, of Partick, adopted the haystack type of boiler in the North British Steam Packet Co.'s new crack steamer *Waverley*, illustrated in our September issue. With the exception of Messrs. Inglis, there is scarcely another firm—apart from Messrs. Hutson & Sons—at all conversant with the building of this type of boiler, and the arrangement and preparation of parts are such as to preclude the ordinary run of boiler-makers from undertaking work of the kind. The amount of flanging, curvature, and smithing of parts is very great, and is of such a character as to necessitate hand work entirely. Messrs. Hutson & Sons have within the past few years turned out some six or seven such boilers to stand a high working pressure, which are now on board paddle steamers plying chiefly in South of England waters. They have at present in hand four boilers of the type, some of them to be worked at 110 lbs. pressure, and to furnish steam for engines of 2,600 I.H.P. The weight of a boiler of this capacity is only about 50 tons, the amount of heating surface being 4,500 square feet. One of these boilers at present in hand is for the renowned river steamer *Columba*, to replace one of the same type installed a good many years ago. Another is for a high-speed paddle steamer for the South of England, the order for which the firm obtained last month. The hull of this vessel, which is to attain a speed of 20 knots, is being laid down in the yard of Messrs. S. McKnight & Co., Ayr.

The Troon shipyard of the Ailsa Shipbuilding Co., was visited by an outbreak of fire early on the morning of the 10th inst. The two-storey building at the north end of the shipyard, used as joiners' and polishers' shops and boatbuilding shed was destroyed. A large quantity of the finer class of woodwork—which was being got ready for four vessels in course of construction—six ship's boats, and most of the carpenters', joiners', and other workmen's tools were destroyed. The damage to building plant and stock is estimated at about £1,500, which is covered by insurance.

The Ailsa Co. have most of their building berths well occupied, and they have lately received from the Glasgow and Londonderry Steam Packet Co. an order to build a screw steamer for the cross-channel trade. The work of construction is to be gone on with at once, so as to have the steamer ready for next season's trade. The engines for the vessel will be supplied by Messrs. Dunsmuir & Jackson, Govan.

Messrs. William Christie & Co., agents for the Crawford patent bulkhead door, illustrated and described in our October issue, inform me that a number of orders for various sizes of these doors have been received since the publication of the notice, and that inquiries are numerous. Altogether, before many days are over, the firm expect to be engaged on one dozen doors of various sizes. They are being manufactured meantime by a Sunderland firm, and the larger number of the orders, so far, have come from north-east coast firms. Messrs. Christie & Co. are now introducing a very special kind of metallic packing for high-pressure glands, about which something more definite will be said in the January issue.

Messrs. Andrew Lamberton & Co., Sunnyside Engine Works, Coatbridge, have leased a piece of ground in Burnbank Road, Coatbridge, owned by the Coatbridge Gas Co., for the erection of a large iron factory. Messrs. Lamberton intend making large castings for engines, &c. This will give employment to a large number of workmen.

Mr. Robert Tennent, Whifflet Foundry, intends making large additions to his work. The additions are necessary, owing to the increased output of chilled rolls for the manufacture of armour plate.

The Metallic Art Co., 53, Waterloo Street, Glasgow, have secured the Admiralty contract for the supply of name and number plates, in either aluminium or brass, for the next three years.

The new dock projects on the Clyde are now to be entered upon practically. At the monthly meeting of the Clyde Trustees, held early in the month, it was intimated that the plans and specifications and all that is necessary to enable the works committee to begin operations at the projected wet dock at Clydebank, are being prepared, and after their being submitted, along with a report, to the consideration of the committee, the work of dock formation will at once be started. The trustees have also decided to ask Parliament, during the coming session, for powers as before to construct a dock at Shieldhall, on the opposite side of the river, and about three miles nearer the city than Clydebank. It is proposed that the dock should be rather smaller than the one which was considered by the Parliamentary committee last session, the plans for which were considered to be rather complicated. The Trust have appointed a sub-committee to meet with the directors of the Caledonian Railway, and with the Glasgow and South-Western Railway, with the view of making arrangements for direct railway communication to the proposed dock. The Trusts' projects will involve the diversion of the main thoroughfare to Renfrew, so that there will be a sufficient amount of land for quay and shed accommodation between the dock and the Clyde.

Arrangements are also now being entered into for the actual start to the Renfrew Dock by the authorities at Renfrew. At a special meeting of the Town Council, held on the 15th of the month, Mr. Ralph Dundas reported that, as instructed by the council at their meeting on September 14th last, he had arranged with Sir John Wolfe Barry. Mr. Forman, and Mr. Colledge regarding the engineering of the works, and was taking steps regarding the raising of the capital for the authorised works. The meeting confirmed the appointment of Mr. Charles Forman and Mr. Francis S. Colledge as joint engineers for the construction of the works, and Sir John Wolfe Barry as consulting engineer, and instructed them to get the working plans completed early. Mr. Dundas further reported that he had arranged a meeting between the engineers of the town council and the engineers of the railway companies to consider as to the railway connection with the harbour.

The Caledon Shipbuilding and Engineering Co., Limited, Dundee, have secured the contract for building and engining a screw steamer for traffic on the Canadian lakes. She will be 255 ft. in length, 42 ft. beam, and 23 ft. 8 in. depth, moulded.

By the serious fire which broke out in the premises of the Dundee Shipbuilding Co. early in the month, some considerable inconvenience and delay were caused, but arrangements were not long in being made whereby the work of the yard was again in full swing. Three steamers are at present on hand, and although seriously handicapped by high prices and poor delivery of material, as well as with irregularity of workmen and loss of working time, the year's working has led to a clear profit of over £200.

Dundee, as well as Leith shipbuilding firms, are being asked by Messrs. James Currie & Co., of the Leith, Hull and Hamburg Steam Packet Co., to tender for two new screw steamers to be added to the large fleet already owned by that company trading between Leith and the Continent.

From the large new engineering and shipbuilding works established at Annan, Dumfriesshire, by Messrs. Cochran & Co., Limited, who have for many years been established at Birkenhead, there was launched during the month the small steamer *Ethelinda*, built to the order of the Embreza Nacional Co., Lisbon. This is the first occasion on which a vessel has been launched on the Scottish side of the Solway. In the days of wooden vessels the villages which dot the shores of Galloway were busy centres of industry, but this was changed with the advent of iron shipbuilding. Messrs. Cochran & Co., Limited, Annan, have contracted with the Admiralty to supply a number of boilers for service at the Cape. The new works are being put on day and night shifts, and the firm have been advertising for applicants for vacancies in all departments of their works.

At Aberdeen the new pontoon dock belonging to the Harbour Commissioners, while being used for the first time, sank in Albert Basin on the 15th inst. The steamer *Carnie* had been placed on the dock with the view of undergoing repairs, and the pumping gear was put in operation. The dock did not rise sufficiently, however, to bear the weight of the vessel, and the *Carnie* having been moved off the structure, it gradually subsided and sank. An inspection by divers revealed the fact that there was a leak in one of the corners of the dock, and that some of the manholes had been displaced, thus allowing the water to rush in. The work of raising the pontoon was commenced in the course of the afternoon. The dock cost £8,000, and was built by Messrs. Clark & Stanfield, London.

Considering that the International Exhibition to be held in Glasgow in 1901 would undoubtedly attract a large number of engineers and shipbuilders, not only from England and the colonies, but also from the Continent and America, the Council have decided to organise an International Engineering Congress to meet in the autumn of that year. A committee has been appointed to study the whole question, and to make the necessary preliminary arrangements. Some progress has already been made, and negotiations are proceeding with a view to obtaining the assistance and co-operation of the great scientific and technical societies in this country. The financial support already promised by members of the institution is such that the committee have no doubt of being able to organise a congress well worthy of the occasion. Lord Kelvin has consented to act as president of the congress, and application will be made to the University authorities for permission to hold the meetings of the congress in the University buildings. There will be a number of sections corresponding to the principal divisions in engineering practice, each section having a chairman and a distinct set of officials. Papers will be read in each of the sections, and doubtless apt illustrations of much that will form subjects of discussion will be found in the exhibition buildings close to the University. Should the promoters and organisers of the 1901 exhibition be successful in the efforts they are understood to be putting forth to make the engineering and shipbuilding exhibits a specially prominent feature, the congress will be held under almost ideal conditions as to date, site, and surroundings.

The Institution of Engineers and Shipbuilders in Scotland held their second general meeting of the present session in the hall of the Institution, Bath Street, Glasgow, on the 21st ult., Mr. Robert Caird, president, in the chair. The discussion on the paper on "Lighthouse engineering at home and abroad," by Dr. J. A. Purves, was concluded. Papers were read by Mr. W. J. Luke—late of the Admiralty and now on the staff of Messrs. John Brown & Co., Limited, Clydebank—on "The means adopted for moderating the rolling of ships," and Mr. John Barr on "Flow of water over bell-mouthed pipes."

At a largely attended meeting of the Scientific Society of the Glasgow Technical College, held on the 18th ult., an elaborate and interesting paper was read by Mr. David Pollock, M.I.N.A., Glasgow, on the subject of "The introduction and development of machine rivetting in shipbuilding." Examples of various machine tools on the pneumatic and other systems and specimens of rivetted work were shown, and an interesting discussion followed, being taken part in by well known local shipbuilders and others.

THE TYNE.

From our own Correspondent.)

Shipbuilding.—During the past few weeks the shipbuilding firms on the Tyne have had a busy time in estimating for new contracts—mostly on terms of deferred delivery—and there is not the least reason to doubt that the total work on hand has been largely augmented. The general impression now is, that at least two more years of full activity in shipbuilding is assured and unless wages difficulties should arise to check the flow of prosperity, the first years of the new century are full of promise for both employers and employed. The wages rates of all classes of shipyard operatives, are now at the highest point ever reached, and it is therefore improbable that any further demands will be made. The management of the Boilermakers' Society, however, will undergo an important change at the end of the year, the present general secretary Mr. Knight, giving place to the newly elected Mr. Cummings, and it is possible that under the new regime, more aggressive tactics may be resorted to than have hitherto characterised the action of that society. There are vague rumours already afloat, of an impending demand for an advance on behalf of the "black squad," but whether concrete form is given to them or not, is a matter which remains to be seen. In reference to this class there is one statement to be made which cannot be denied, and that is, the more wages they receive, the less they are inclined to work. That undeniable fact will furnish the employers with a strong argument against granting any claim for a further advance, should such be made; and in view of the circumstances that little better than two-thirds of the available time has been worked during the present year, the officials of the Boilermakers' Society will have a hard task before them, if they try to persuade the masters that a higher rate of remuneration is needed.

It will not surprise our readers to learn that Messrs. Swan & Hunter are among the firms that have added to their prospective work engagements lately, the orders booked by this firm being, we believe, of an exceptionally important class. The work on the stocks at the moment, comprises one or two cargo-passenger boats of superior type, and several vessels of a less costly kind; while, in the water, a couple of vessels are being fitted out. The firm have added some new machines of an interesting and effective kind to their already extensive plant, and it is understood that the covered building berths in the east yard - which form such a unique spectacle on Tyneside, and which are over 600 ft. long—are to be further lengthened, with a view to the accommodation of vessels up to 700 feet. The firm are making a bold bid for pre-eminence in the shipbuilding world, and there is no reason to doubt that the enterprise of this and other firms on the Tyne and Wear, has had a stimulating effect upon the industry.

Messrs. Wigham, Richardson & Co. have secured some additional orders, and have the two big boats in the east yard (a piece of ground added lately) well advanced in construction. These vessels which are each over five-hundred feet long, have, we understand, been ordered by the North German Lloyd, and the Pacific Steam Navigation Co., respectively, and they will both be finished and equipped in a very superior style, to fit them for the services intended. The addition of a further considerable area to the yard has involved the erection of new shops, and the putting down of additional machinery, and the productive capacity of this ancient, but thoroughly up-to-date, establishment has thus been very largely increased. As has been indicated, the yard is one of the oldest on the Tyne, or in the country, and it is much to the credit of the gentlemen who for so many years have had the direction of its destinies, that it is to be numbered amongst the shipbuilding establishments of the kingdom that possess the best appliances and the largest resources for carrying on work.

Messrs. Armstrong, Whitworth & Co., have an abundance of work for both their Elswick, and Low Walker yards, the berths of the former establishment being fully taken up with war ships of various types; while, in the latter, several exceptionally large mercantile vessels are in course of construction. A vessel intended for the carrying of oil cargoes from the East, was launched a few days since, and a special interest attaches to it from the circumstance that it is the largest oil ship afloat, and that the fuel to be employed for purposes of propulsion, is liquid. Messrs. Rusden & Eccles' system of oil burners, which has proved so satisfactory on other vessels of the "Shell" line (the owners of which ordered the present vessel) is we understand to be fitted, and will doubtless give the satisfactory results anticipated. The very large extensions which have been in progress for some time, are now approaching completion, and additional machinery is being placed in position.

The Tyne Iron Shipbuilding Co., Limited, have received among other orders, one from a Newcastle firm for a steamer of large size, and their designing department is, at the moment, particularly busy. Within the past year or two the company have practically renewed the equipment of the yards in the matter of machinery, and one of the results which may be expected to arise from the improved arrangements will be an increased output this year, as compared with former years. Messrs. Wood, Skinner & Co. are understood to have received some orders lately for steamers of moderate size to be employed in the coal trade, and their building berths are fully occupied. Messrs. Dobson & Co. have also a good show of work in their yard, the keel for a large vessel having been recently laid. The firm have some foreign contracts in hand, and it is rumoured that negotiations have been opened in respect of others.

The Palmer Co.'s Yard, at Jarrow, continues to exhibit great briskness, and the construction of the Admiralty work in hand, is being pushed forward with all possible despatch. The plating of the cruiser is now well advanced, and other Government vessels are in very forward stages, considering the dates on which their construction was commenced. The company have several very large merchant ships on the stocks and in the water, and there is reason to believe that there are some good orders in reserve.

It may not be uninteresting to state that there is a cycle manufacturing department connected with the Palmer Co.'s works, and that an excellent reputation has been achieved by the company's products in this line. We now hear that they are bringing out a new design of cycle, which has elicited the unstinted praise of experts, and is likely to further enhance the reputation of the company in this line of business.

Messrs. Hawthorn, Leslie & Co., are understood to have orders sufficient to last for many months yet, and the contracts in hand are being energetically pushed on towards completion. The torpedo destroyer *Viper*, which was launched a few weeks ago, and has been fitted with Parsons' turbine engines, had some preliminary trials lately, and under very bad conditions of weather, made several excellent runs. The speed attained was much above the 31 knots guaranteed, and quite exceeded anything yet done by vessels of this class. It is quite on the cards that the turbine principle as applied to marine engines, will prove a great success, many people going so far as to predict the attainment of a speed equivalent to 50 miles per hour. The graving dock connected with Messrs. Hawthorn, Leslie & Co.'s yard, is kept pretty constantly occupied, and the pontoons and dock belonging to the Wallsend Pontoons Co., have also been in constant requisition for some time past. The other docks and slipways on the river, are pretty generally engaged with vessels undergoing painting or repairs, and in the smaller yards of the lower reaches a good business is being done in the building of trawlers and other small craft.

Engineering—We have reason to believe that several new contracts of importance have been secured recently by the leading engineering establishments, and in some cases a resort to night work will again be found necessary. Locomotive works are well supplied with orders, and will be further strengthened (it is expected) by a large order from the Midland Railway Co. Northern built engines, which have been supplied to that company, are said to have given great satisfaction, and we have it on good authority that an order for 50 engines, to be divided between two Newcastle firms, will shortly be forthcoming.

A new boiler feed pump of the compound direct-acting type has recently been supplied to the Blaydon Ironworks, and has given excellent results, maintaining the supply of water to a boiler that has a maximum working pressure of 300 lb. The pump, which has been patented by Mr. J. P. Hall, of Peterborough, differs from the ordinary type in one important particular, the effect of which is a saving of 50 per cent. in steam consumption per unit of power used. The economy cannot fail to attract very general attention to the type, which is admirably adapted for use on steamships, where fuel economisation is a matter of vital consequence. Works for the manufacture of these pumps have been established by Messrs. J. P. Hall & Sons, at Peterborough, and Mr. C. H. Tate, Side, Newcastle, is the firm's representative on the North-East Coast.

Mr. W. F. Snowdon is doing an excellent business on the Tyne and Wear in the sale of that well-known speciality, Morison's evaporator, for which he is agent. Evaporators have now become a necessity on steam ships, and among the many contrivances of this kind on the market there are few, if any, that have attained so widespread a popularity as Morison's. Such is the demand for this article indeed, that the department set apart for its manufacture at Messrs. Richardson's works, Hartlepool, has had to be extended, and is now, with its enlarged capacity for production, kept going night and day.

Mr. L. Rusden, Royal Insurance Buildings, Queen Street, Newcastle, has during the present year had very marked success in the sale of Deighton's patent furnaces for marine and land boilers, in respect of which he is the accredited representative for the Tyne and Wear and north east coast generally. Latterly he has secured very large orders in all parts of the district indicated, and there is every reason to expect that the sale of this speciality will be largely increased in the coming year. Mr. Rusden has just added to his other agencies the representation of the new "Durr" light throughout the northern counties. This light is eminently suitable for ship yards, engine works, graving docks, &c., being very portable, easily fixed or removed, and simple to manage. The apparatus is constructed on a different principle to other contrivances of a similar kind, working automatically and without the employment of compressed air. It possesses many other advantages peculiar to itself, and is certain to be largely adopted wherever the absence of electrical installations gives scope for the employment of mechanical contrivances for providing and maintaining a powerful light in the open air.

Messrs. Isdale & Farrow, of St. Nicholas' Buildings, Newcastle, who towards the close of last year were appointed agents on the North-East Coast, for the Clydeside Tube Co., Limited, have already succeeded in establishing an excellent business connection in the district, and have secured a large number of orders during the year. Quite lately they have obtained from leading engineering firms some exceptionally large orders, and have also negotiated a number of good contracts, involving the fulfilment (in each case) of requirements in the way of iron and steel tubes over the whole of next year.

Messrs. Thomas Proctor & Son, ironmongers and manufacturers, Side, Newcastle, and South Shore Road, Gateshead, have a large number of orders for ventilators, tanks, and other steamship accessories, and their extensive works at the latter place are kept exceedingly busy. The extensions which have been in progress for some time are practically completed, and when the machinery equipment is finished, the productive capabilities of the firm will, it is expected, be equal to all calls that are likely to be made upon them.

Electric Lighting—Messrs. J. H. Holmes & Co., Messrs. Clark, Chapman, & Co., and Messrs. Scott & Mountain, are all well supplied with orders, the two former in ship lighting and general work, and the latter in power and lighting installations for collieries, mills, &c. A new firm, under the style and title of Carrick & Stevenson, have commenced business as electrical engineers at No. 34, Side, and have succeeded in obtaining a large amount of work. The firm, we believe, intend going in for both ship and colliery work, in which branches the partners have special experience.

Suffolk.—On November 20th the large screw-steamer *Suffolk*, (of which we gave full particulars in our launch columns, September issue, page 264) built by the Sunderland Shipbuilding Co., Limited, to the order of Messrs. Birt, Potter & Hughes, Limited, of London, for their well known line of Australian steamers proceeded to sea on her trial trip. She had on board a large cargo of railway iron and coal and when run over the measured mile at Whitley gave a very satisfactory result.

Messrs. Gourlay Brothers & Co., Dundee, have secured an order for a paddle steamer to be employed in the Great Eastern Railway Company's service from Harwich.

The Nova Scotia Steel Co., New Glasgow, N.S., is building another smelting furnace. The large steel building will be extended some eighty feet to cover the new furnace and bring the steel travelling crane in connection with it. The furnace will produce 100 tons a day.

THE WEAR.

(*From our own Correspondent.*)

Shipbuilding.—In the distribution of new orders for ships, it may safely be presumed that Sunderland firms who are in a position to accept additional work, have not missed getting a fair share of what was going, and we believe, as a matter of fact, that several new orders have been lately placed. Among the Wear shipbuilding firms however, there are some who do not care to add to their responsibilities, especially while prices of material are so high, and still inclining upwards. Any firm, indeed, that is already well booked forward, is scarcely likely to be solicitous just now for further work, excepting on conditions of long terms, for building, and at a considerable advance upon recent prices. Shipowners who can succeed in placing orders just now, excepting at enhanced rates, must be looked upon as rather lucky; for, in all probability, prices will go much higher by the end of the year.

The launch on the 17th ult., by Messrs. Doxford of the s.s. *Skandia*, ordered by Dutch owners, made the firm's seventh launch for the year, the aggregate tonnage of the vessels put into the water, coming well up to 30,000 tons. The large vessel which the firm are building for the P. & O. Company, is well advanced, and may possibly be ready for launching by the end of the year. Should this happen, the firm's output for the year, will reach a figure not likely to be beaten by any firm working an equal number of berths. The firm, it may be stated, have five berths; but one of them is usually occupied with a government vessel, and it is well known that these do not count very materially, in the estimating of output.

Messrs. Pickersgill have now about completed the new shops with their machinery equipment, and will doubtless be able to turn out much more work next year than they have done in any year of the past. Messrs. Robert Thompson & Sons have a good supply of work for their Southwick yard, and at their graving dock works near Sunderland Bridge there is a lot of work in hand. The principal contract just now being dealt with is the overhauling of the s.s. *Remembrance*, belonging to Messrs. Frear & Dix, and built by Messrs. Short Brothers nearly twenty years ago. In her long career the vessel has not, we understand, required very much, beyond the ordinary surveys, in the way of repairs, and the state of preservation in which she now appears is a strong testimony to the soundness of her original construction.

At Sir James Laing's yard there are two repair contracts in hand, in addition to the new work, and all departments continue busy. The Sunderland Shipbuilding Co. are also full of work, and have been complimented by a Government official on the superior manner in which the s.s. *Wakool* built by them and chartered for the South African service, has been "found" and equipped. Messrs. Blumer & Co. have the largest ship ever built by them now on the stocks, and at the Strand Shipbuilding Co.'s yard there are two vessels in hand, besides repair work.

Messrs. J. L. Thompson & Sons are, as usual, extremely busy, their initiatory departments showing quite a pressure of work. A very fine vessel is being fitted out at the Manor's Quay Works, and there is also some repair work in hand.

Engineering.—At all the marine engine works full activity is maintained, and the smaller engineering works are also kept steadily going. The Sunderland Forge and Electrical Works continue to show a high state of briskness, and in both branches the outlook for next year is excellent. We understand that Mr. Crawford, who for several years past has held the position of manager (under Mr. Irwin) at the North-Eastern Marine Engine Works, Sunderland, is about to undertake similar duties at the works of Messrs. Fawcett & Preston, Liverpool. Mr. Weir, head draughtsman at the North-Eastern Works, Wallsend, will succeed Mr. Crawford at the Sunderland works, and will commence his duties on the resumption of work after the new year holidays.

We hear that a large order for triple-expansion engines has been placed with Messrs. George Clark, Limited, Southwick, and though we cannot actually vouch for the truth of the statement, we have reason to believe that it will be found correct.

Iron foundries are keeping busy, and the same may be said of brass and copper works, rivet works, anchor works, forges, and iron rolling mills. Other industries may be described as fairly prosperous.

The Hartlepools.—During the week ending November 18th, four vessels were launched at this centre, the aggregate tonnage of which amounted to 35,000 tons, two of them representing a carrying capacity of 12,900 and 10,666 tons respectively. This is an extraordinary achievement in a shipbuilding centre having only three firms, and it may be doubted if it has ever been surpassed at centres having three or four times the number of firms. The circumstance says much for the capacity and enterprise of the firms concerned. Engineering works continue fully employed, and at the docks, business, particularly in timber importation, is very brisk.

Stockton.—Shipbuilding and engineering—both marine and general—continue brisk at this centre, and there is rather an increase than otherwise, in the pressure of work at the steel and iron manufactories.

Middlesbrough.—The shipyards continue to show fully occupied berths, whilst engine works and boiler and bridge works are apparently busier than ever. Local bridgebuilders have been intrusted with large contracts for bridges, to be shipped to South Africa, and are doing their utmost to give earliest possible delivery. Steel works are pressed with orders, and prices still tend upwards.

Consett.—The activity at the Consett Co.'s Iron and Steel Works, shows no sign of slackening, and a very high average of weekly output is maintained. The company's resources are being extended wherever possible, with a view to cope with requirements.

THE MERSEY.

(From our own Correspondent.)

THROUGHOUT practically all the leading branches of engineering in this district, establishments continue actively engaged, with a prospect of full employment for a considerable time ahead. Heavy stationary engine builders are perhaps not quite so pressed as they have been and textile machinists report work running out faster than new orders are coming in, but in other departments exceptional briskness prevails. Machine tool makers continue especially busy, both for general and marine and ordnance requirements, and they are as a rule assured of being kept fully going at any rate over the ensuing year. Locomotive builders and boiler makers are in a similar satisfactory position, whilst hydraulic engineers are also exceedingly well engaged, and in electrical engineering the tendency is towards an even greater pressure of work than that which has recently been experienced.

The monthly returns of the leading engineering trade unions continue of a very satisfactory character. The Amalgamated Society of Engineers reports a further reduction in the number on unemployed benefit, which now represents about 2¼ per cent. of the total membership. Locally the position is even better, as there are now less than 2 per cent. on donation. This is largely due to the number of men that have been sent from the Manchester office to Barrow-in-Furness during the last few weeks, owing to the large demand in the last named town for men accustomed to engine, tool and gun work. The Steam Engine Makers' Society has about one per cent. of its total roll on benefit, and the officials report an almost daily demand for men for the Government Dockyards that they are unable to meet. Locally this organisation has still practically a clear book. The United Machine Workers' Association has about two per cent. of the total list on donation, whilst in the Lancashire district the general average is only about one per cent., a considerable number of the branches having no names at all on the trade donation list. As regards labour and wages questions, there is this month nothing of any exceptional moment to report.

In a paper read before the Manchester Association of Engineers on November 11th, Mr. J. E. Fletcher, of Sheffield, made some interesting remarks with respect to the difficulties attending the production of castings for engine boiler and pipe connections for marine requirements. Of late years, he said, boiler manholes, safety valve seatings, stop valve bodies, and similar details had been much used as steel castings, and their manufacture had been successful, except in cases where the desire to eliminate weight had led to contractional flaws and blow holes. Recognising the fact that high pressure steam was to be the rule of the future, steel founders had made every effort to produce the intricate pipe connections between boiler and engine now required. In the Navy the introduction of the Belleville boiler had led to the use of steel castings of most intricate form, some of which had been produced successfully, but in the case of others waster after waster had rewarded the founders' efforts. Some of the exceedingly light designs that had been attempted in castings for high pressure boiler work were dangerous, and the use of them must sooner or later lead to accident. The cost of such castings was very great, and delays due to foundry failures were frequent. He believed he was perfectly correct in saying that on several occasions the completion of warships had been delayed simply on account of the difficulty in obtaining delivery of steel boiler castings of the intricate order to which he had referred.

Messrs. Craven Brothers, Limited, of Manchester, have recently completed a number of exceptionally heavy machine tools, specially adapted for marine engineering and ordnance requirements, of which a few particulars will be interesting. One of these is a special gun tube and shaft boring machine, weighting 62 tons. This has two driving headstocks and may be used as one machine for boring up to its maximum capacity when operating from both ends at the same time, or as two separate machines when boring from one end only. The driving headstocks have revolving hollow mandrils, the face-plates on which are fitted with four gripping jaws with case-hardened removable fronts, to grip large and small diameters of forgings, so that any type of jaw may be affixed to suit the work. The face-plates and mandrils are each driven by a worm and worm wheel with three sets of changeable spur gearing and two speed cone pulleys, giving six different speeds.

Another new design is a double-ended ingot boring machine, weighing 46 tons, and capable of boring ingots from both ends at the same time or either end separately as required. The foundation bed, which is 44 ft. long, has its upper surface planed with slots the full length, to receive the two top beds carrying the boring headstocks and guide pedestals for supporting the out ends of the trepanning bars. The machine is driven by fast and loose pulleys, or electric motor as desired, with a clutch to stop or start each head to work them either together or separately.

The firm also make a special double spindle horizontal and vertical milling machine that will mill surfaces to right angles, and the spindles of which may be used separately for either vertical or horizontal milling, whilst the vertical spindle is arranged to work with a profile shaper. The bed is arranged to form a cistern for the lubricant. The spindle carriage is carried by a balanced cross slide, adjustable vertically on the face of the uprights by strap power to suit the work fixed on the table. The spindles run in adjustable conical gun metal bearings. The table has planed T slots with a dish round it to catch the cuttings and lubricant, which is conveyed back to the cistern in the bed. The table has an automatic stopping motion to arrest the traverse at any desired point. It may be added that the firm have also just completed an exceptionally large 42-in. centre planing machine, which is 47 ft. between the centres and 60 ft. long, and weighs 92 tons, whilst they have another machine of the same size on order.

Messrs. W. Muir & Co., Limited, of Strangeways, Manchester, have recently completed an improved double spindle profiling and general milling machine, specially designed for milling two connecting-rods at the same time from one former plate. The spindle slides have spindles 4 in. diameter, and provided with Alfred Muir's patent couplings for readily securing and releasing the mandrils, for cutters, and constructed to work either independently or simultaneously. Each carriage has a disengaging motion so that one or both can be worked or stopped from the one driving shaft, and arrangements are also provided for coupling both carriages together by means of an adjusting screw for profiling in unison along the sides of two sets of work from one former plate. The cross slide is balanced and raised or lowered by power. The machine is provided with practically two tables, the main one being a rectangular table with T slots, and provided with troughs all round the outer edge to drain away the lubricant back to the cistern in the bed of the machine, and is fitted with self-acting longitudinal reversing hand feed motions, and quick traverse in either direction by power. This table is 10 ft. long by 5 ft. wide, and the machine will admit 5 ft. 6 in. between the uprights, and 5 ft. in height between the cross slide and the table. The subsidiary table is circular and 3 ft. in diameter, arranged to fit on the rectangular table, from which it can be readily removed when not required. This smaller table is self-acting by worm and wheel. The cutter stays are arranged to take cutters 9 in. diameter by 13 in. long; all the slides are fitted with index rules, and a centrifugal pump is provided for lubricating the cutters. The machine weighs 25 tons.

During the past month there has been a continued upward move in prices, both for raw and manufactured iron. In pig-iron makers' quotations have advanced from 1s. and 1s. 6d. up to 3s. in some cases, and although buyers are following the rise rather cautiously, and there is underselling by merchants in some brands, makers, who are generally heavily sold for some time forward, are generally firm at their full rates. Local makers are now quoting 79s. 6d., less 2½ for foundry qualities. For Lincolnshire foundry makers have hardened up 2s. 6d. to 3s. per ton, and are now asking 76s. 6d. net, whilst Derbyshire, which has made a similar advance, is now nominally quoted 80s. to 82s. 6d. net, delivered in Manchester. Forge qualities are also about 3s. dearer, Lincolnshire makers asking 75s. 2d. net, with Lancashire about 77s., less 2½ delivered Warrington. Middlesborough iron is 1s. to 1s. 6d. higher, ordinary foundry brands averaging about 78s. 10d. to 79s. 4d., with some makers now quoting 80s. 4d. net, by rail, Manchester. In Scotch iron there has been an upward move of about 1s. 6d. per ton, Eglington and Glengarnock averaging about 80s. to 80s. 6d. net in the open market, with makers asking about 2s. more, delivered Manchester docks.

In the finished iron trade exceeding activity is reported, with makers, who are sold far into next year, in most cases having to decline a large weight of business that is offered. Quotations all round have been advanced 10s. per ton, local bar makers now asking £9 10s., with sheets £11, and list rates for hoops £9 17s. 6d. for random to £10 2s. 6d. for special cut lengths delivered in Manchester district, and 2s. 6d. less for shipment. Nut and bolt makers have put up their list rates 20s. per ton, and a further advance is not improbable.

Prices in the steel trade have also shown a strong upward move. Hematites are 2s. to 3s. dearer, the average quotations for No. 3 foundry qualities being 90s. 6d. to 93s., less 2½. Billets have risen about 5s. per ton, local makers quoting £7. For bars local makers' minimum for ordinary basic qualities is now £9. Plates range from £9 for tank qualities to £9 10s. and £9 12s. 6d for boiler plates. Hoops have been put up 10s. per ton, £10 being the new quotation.

The only alteration to record in the metal market is a reduction of ¼d. per lb. in list rates for condenser plates. Other descriptions of manufactured goods are firm with an active demand to meet boiler makers, locomotive builders' and general engineers' requirements. Delivered Manchester district, list rates are as under:—Solid drawn brass boiler tubes, 9d.; condenser tubes, 10½d.; copper tubes, 11½d.; brazed copper gas and steam tube, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d.; common brass wire, 8½d.; copper wire, 8¼d. per lb.

In the coal trade an exceedingly strong tone is reported, and list prices have not been generally advanced with the commencement of the month. So far as house-fire coals are concerned business has been only moderate, but as the men have been working only indifferently at pits—evidently with a view of strengthening their position on the wages question—stocks are not being increased to any very appreciable extent. Steam and forge coals are in brisk request, the activity in the iron and engineering trades keeping up large requirements, and all the output is moving away; in fact in many cases it is short to meet the demand. In engine fuel the demand is fully sustained, collieries in fact reporting it largely in excess of their present production. The average rates are now 13s. 4d. to 13s. 10d. best Wigan Arley; 11s. 8d. to 12s. 6d. Pemberton four foot and seconds Arley; 10s. 6d. to 11s. common round coal; 7s. to 7s. 6d. common slack; 8s. to 8s. 6d. good medium sorts; and 8s. 6d. to 9s. 6d for the very best qualities.

Shipping enquiry is increasing with prices hardening, 12s. being now generally quoted for steam coal delivered Mersey ports.

Coke is in pressing demand, which is more than sufficient to take away all the output. Prices have shown a further stiffening, 28s. being now quoted for good foundry qualities, and 21s. to 22s. for ordinary furnace cokes at the ovens.

Scotch Steel Makers have advanced the price of steel boiler plates 5s. a ton, the quotation now being £9 10s., less 5 per cent. Steel bars have also been raised 5s. a ton to £9.

THAMES.

(From our own Correspondent.)

MESSRS. TOLCH & CO., of Fulham, are making arrangements for a large extension of their works. It is the intention of the firm to establish a new department outside of the launch and oil engines which will extend to a greater area than their present premises.

The two large launches which the firm built and engined for the Egyptain Coast-Guard service have now been delivered and are in use, the one at Alexandria the other at Port Said. They were to be fitted with a search-light. The speed got out of the two boats was an easy 7½ knots. Now when the Army Corps is in South Africa and about to operate across the Orange River one would have thought that a few flat gunboats or large launches would have been of considerable service cruising about on the border river. Such craft would have been very useful in patrolling in the vicinity of the bridges and preventing the enemy from placing mines about them for blowing them up. As there is plenty of petroleum oil about the country such fleet gunboats or large launches could have been simply fitted with oil engines, and not shown any smoke. On the Niger the firm have several of their launches at work, some also are at use in the pearl fishing of Madagascar, and others in Siberia.

Vauxhall Iron Works.—This firm is building some small tandem compound engines. They are of the tandem two-cylinder, two-stage expansion type. The cylinders are 7 in. and 12 in. diameter with one piston rod, the two pistons drive a single crank of 8 in. throw. The engine is non-condensing, and of 40 H.P., and is to be applied to drive a four-bladed screw 2 ft. 6 in. diameter fitted in a shallow draught steamer, building abroad for use on African lakes. The pressure of steam for which the engines have been designed is 180 lbs. to the square inch, and the number of revolutions will be 350 per minute. The slide valves of the engine are moved with the same valve rod, the high pressure cylinder is served with a piston valve, and the low pressure with a flat slide valve. As the engine has a high speed the bearings have been made exceptionally long. The frame and bed-plate are of toughened cast iron, and the columns, crank shaft, and piston rod are of forged steel. The thrust block consists of gun metal horse shoes. There is a single hand lever to reverse the engine. Steam will be supplied by a water-tube boiler.

BELFAST.

(From our own Correspondent.)

THE shipbuilding and engineering industries here continue to be in the same normal condition as chronicled last month, but it is reported on good authority that an amicable settlement between Messrs Harland and Wolff, Limited, and the Belfast Harbour Commissioners has been arrived at, although details have not yet reached us. If reports are true, this firm require ground for building an addition to their works in the shape of a large forge to enable them to make their own forgings, and this will give additional employment to a large number of men, so that, this matter being settled, we are likely to have this firm with us for many years to come, notwithstanding the "bids for their patronage" from all parts of the kingdom.

During the month the new steamer *Persic*, of the White Star Line, left this port for Liverpool. This is the third of five steamers which Messrs. Harland & Wolff have in hand for Messrs. Ismay, Imrie, & Co., to run on their new monthly service, *via* the Cape, from Liverpool to Australia. The dimensions of the *Persic* are:—Length 550 ft., breadth of beam 63 ft., depth 44 ft., and gross tonnage, about 12,000 tons. The vessels forming the fleet have been specially built for the particular trade, and the new service is of special interest to the port of Liverpool. inasmuch as large quantities of the products of the colonies will no doubt be landed there in future direct from Australia. Although the accommodation is for third-class passengers, yet that accommodation is of such an exceptionally luxurious character that really, saving the decorative element, it is practically equal to the provision made on many of the best modern passenger steamers for saloon passengers, and superior to that in many of the older lines. The fact that the upholstery work is not so obtrusive will, in fact, be an advantage when passing through tropical climes, and with plenty of air, which the ample dimensions of the ship will afford, the maximum of comfort on board will be obtained. The dining-room, which is amidships, is large and airy, and fitted with separate revolving seats, whilst the promenade available on the main deck, fore and aft, is also very wide and spacious. The *Persic* is commanded by Captain Inman Sealby. She is propelled by twin-screws, and her machinery has also been constructed in the builders' own works.

On the 18th inst. a large steel steamer was successfully launched from the north end of Messrs. Harland & Wolff's yard. That vessel is named the *Minneapolis*, and has been built for the London and New York service of the Atlantic Transport Line. She has a gross tonnage of about 13,700 tons, and her dimensions are:—Length 600 ft., breadth 65 ft., depth 44 ft. She will have twin-screw propellers, driven by separate sets of quadruple expansion engines, and, besides having accommodation for a large number of first-class passengers, will have a large cargo and dead meat capacity, and be fitted up to carry 676 head of cattle on the upper deck, as also with permanent stalls of the most improved kind for nearly 200 horses on the same deck.

Messrs. Workman, Clark & Co., Limited, launched on the 3rd November, a handsomely modelled steel screw steamer named the *Lord Downshire*, built to the order of the Irish Shipowners Co., Limited, Belfast.

The s.s. *Sicilian*, the new Allan liner built here by Messrs. Workman, Clark & Co., which as mentioned last month had been chartered by the Government to carry troops, &c., to the Cape, left this port on the 3rd inst. for London, whilst there she was inspected by several experts, who report her to be a model troop and store ship, her large size and beam, with the large spaces at command for fittings and accommodation giving ample fresh air and freedom to all on board. We understand she has since sailed for her destination.

The s.s. *Christiania*, of the Hamburg-American Line, has been in the Hamilton Graving Dock here for the past fortnight receiving extensive repairs and alterations to her hull, &c., which are being carried out by Messrs. Harland & Wolff, Limited, whilst the s.s. *China* is near completion and will soon be afloat again.

Messrs. McColl & Co., Limited, engineers, &c., have launched a new cross river ferry boat for the Belfast Harbour Commissioners, and are at present engaged making steam cranes for the same company.

Mr. Joseph Lewis, consulting engineer, has, we believe, placed orders on the Tyne, for at least two rather large steam vessels for the North of Ireland Steam Navigation Company. He has also several vessels under contract on the Clyde for local firms and also smaller craft being constructed at Larne. We hear that Mr. Lewis is adopting the Deighton Furnace in all these new steamers. This furnace we understand is being very freely adopted and is proving highly satisfactory.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—The shipbuilding and marine engineering industry at Barrow remains in a very active state. Messrs. Vickers, Sons & Maxim, who have generally turned out about £500,000 or £600,000 work per year, have contracts in hand for the next two-and-a-half years representing £4,000,000, and all the orders are for pressing delivery. Under the circumstances, therefore, it is impossible for the firm to enter into any new contracts requiring early attention, and the company consequently are respectfully refusing to tender for many of the important contracts which are on offer in the market. A larger number of men are employed at the Barrow yard than was ever previously the fact, and many more would be employed if it were possible to get houses for them to live in. New property is being built on a large scale in various parts of the town, and it is probable that the spirit shown by builders will be very much increased with the turn of the year. Much progress has been made in the building of the first-class British cruiser *Hogue*, but the builders will not be able to launch her before Midsummer next year, owing to the deepening operations at the docks at Barrow, but this will mean when the cruiser is launched she will be well forward in her construction, as ships generally are launched at very heavy deadweight at Barrow, and the delay in her launch will not mean delay in the date of delivery to the Admiralty. Her engines and auxiliary machinery are very well forward, as also her Belleville boilers. The sister ship of the *Hogue*, the *Euryalus*, is gradually lifting her sides, and the larger cruiser *King Alfred* is beginning to display her great length and breadth. The Japanese battleship is gradually lifting its massive frames, and it is understood the Japanese Government are anxious to get her as soon as possible. Under the best conditions that will not be possible for two years, and in the meantime this will mean a very great deal of work to be done, but day by day the Barrow yard is getting more and more fit to tackle the work on hand and give it the best despatch. New machinery, new departments, extensions to the yard, and every modern facility which science and practice has suggested is being adopted. Several new foundries for iron, steel and brass are to be built, and the already large gun-mounting shop is to be doubled in size because of the large amount of business passing through it. During the past few weeks Messrs. Vickers, Sons & Maxim have been entrusted with the order to construct the gun mountings and the guns of four warships for Her Majesty's Government. This, in addition to the large orders already in hand in this department, will ensure activity in the gun-mounting branch of the Barrow works for two or three years.

The Ramsden Dock at Barrow has not yet been closed for the purpose of sinking the dock sill 6 ft., but it will be closed some time during December, so soon as the four deep water berths in the Ramsden Dock entrance basin have been completed. Then it is expected the work of lowering the sill will be accomplished by the end of May next. After that the largest and deepest draught ships can enter or leave Barrow docks at high water. This it will be readily understood will be of the greatest possible advantage to shipbuilders.

The workmen who live on the s.s *Alaska* at Barrow have not got on very well together under the arrangements made for their comfort and convenience on board the ship, but now the control of the ship in every respect is invested in a committee elected by the men themselves, and this committee is not only answerable for the order of the ship, but for the commissariat for the sanitary arrangements generally. It is believed the ship will become a more popular home under these conditions.

The engineering and boiler-making departments of Messrs. Vickers' works are very fully employed. Never at any time were the works so crowded with orders, and all the available machinery and all the available men are employed.

Mr. James Dunn.—Mr. James Dunn, the naval director of Messrs. Vickers, Sons & Maxim, had a narrow escape on the morning of November 20th of being suffocated by fire. He was staying at Furness Abbey Hotel and went to bed as usual about 11 o'clock. He was awoke about three o'clock by a fit of coughing, and then found his bedroom full of smoke. Although half suffocated he managed to make his way to the door along the Batchelors' Corridor to the bedroom of the manager, Mr. Trefenbock. On examination it was found that a fire had taken place under the hearth of Mr. Dunn's bedroom, and it soon began to spread. Grenades and buckets of water were used to extinguish it, but ultimately it was found necessary to telephone for the Barrow Fire Brigade which were on the scene about half an-hour afterwards. By this time the fire had got well hold of the south wing of the hotel, and before it could be extinguished, Mr. Dunn's bedroom together with several of the bedrooms on the same floor and also the bedrooms on the floor above were destroyed, the fire breaking through the roof in several places. The chef of the hotel had a narrow escape, and Mr. Dunn, although he helped in the effort to extinguish the fire, was very much shaken. A portion of his clothes were destroyed, and it was feared that several valuable papers belonging to Messrs. Vickers Sons & Maxim were burnt up, but fortunately the travelling bag in which these papers were deposited, although absolutely charred and destroyed, was found to have preserved its contents. Mr. Dunn lost a valuable dressing case, some jewellery, &c. He has since been the recipient of many congratulatory messages from gentlemen connected with the Admiralty and the shipping interest generally on his very narrow and fortunate escape from suffocation.

West Cumberland.—The shipbuilding trade in West Cumberland is remarkably brisk, and both at Maryport, and at Workington, orders are largely held for light tonnage craft. Business in Maryport is on steady and satisfactory lines. Messrs. R. Ritson & Co., launched from their Maryport yard on the 6th. November, a finely modelled screw steamer, which has been built to the order of Mr. H. Podens, of Wismar. The vessel was launched broadside on. She has a cellular double bottom, and has been built to pass 1st class at Germanischer

Lloyd's. Her dimensions are: Length, 190 ft.; breadth, 30 ft.; and depth over marking, 15 ft. 1 in.; and her deadweight capacity is 1,100 tons. She has been named *Thomas Leigh*, and she was launched by that gentleman. She will be fitted by Messrs. McKie & Baxter, Glasgow, with triple-expansion engines. Other new work is going down at the Maryport yard. At Workington, Messrs. Williamson & Sons have a full order sheet of small craft which represent profitable business. There is every prospect that at both the Maryport and the Workington yards, builders will have plenty to do for many years to come as a good string of regular business falls to their lot, indeed even in quiet times West Cumberland shipbuilders are invariably busy.

A Good Old Chestnut.—Every year when the municipal elections are on at Whitehaven, the good old town is promised a revival of its old shipbuilding industry, and this year has proved no exception to the rule. The Mayor of Whitehaven, Mr. Musgrave, hinted in his inaugural speech, and he anticipated during his year of office this industry would be renewed. It is a very worthy ambition though the worst has been trotted out so often that one begins to regard it as a chestnut, yet there is plenty of money, and plenty of enterprise in Whitehaven to remove this old yard, and if the needful is forthcoming, there is no reason why under capable management, shipbuilding in Whitehaven should not pay.

Shipbuilding Material.—A marked improvement has asserted itself in the shipbuilding material trade, and the improvement which has set in, is taken as evidence of the good demand at present felt for shipping tonnage generally. Steel ship plates are very brisk at the improved price of £7 per ton, and new business is not only of a very pressing character, but makers are already very fully sold forward. The greatest activity is maintained at both the heavy and the light mills which work regularly night and day, Sundays excepted. There is also a brisk demand for steel boiler plates, which are quoted at £9 per ton, and orders for which have been very largely placed. Prices are quoted at £9 5s. per ton. The heavy steel castings are in full request for engineering and shipbuilding purposes, and the foundries in the district are all very full of orders, and makers have really undertaken more work than they can get through comfortably. Good long prices are quoted for heavy castings, and are readily paid. Other branches of the shipbuilding material trade are very busy, and are likely to remain so as orders are not only numerous, but they seem to be on the increase, and certainly prospects for the future are very good.

The Hematite Trade.—A very brisk demand is maintained for hematite pig-iron, and business during the past month has been done on a large scale. The output of the district is in fact not enough to supply the demand, and prices have consequently been forced up. Makers are quoting 80s. per ton for mixed Bessemer Nos. net f.o.b., and are very fully sold forward. Warrant iron is at 78s. 7½d. net. cash sellers, 78s. 7d. buyers. Stocks have been substantially reduced, and now stand at 216,190 tons, but they are still 40,211 tons higher than at Christmas, therefore recent reductions are of interest as giving strength to the market. There are 47 furnaces in blast, as compared with 40 at the corresponding period of last year.

Shipping.—The shipping trade is very fully employed, and the exports of pig-iron and steel are well maintained. The total exports this year have reached 462,265 tons of pig-iron, and 431,648 tons of steel, as compared with 469,251 tons of pig-iron, and 468,761 tons of steel in the corresponding week of last year, showing a decrease of 6,986 tons of pig-iron, and 37,113 tons of steel, as compared with the corresponding week of last year. Coasting shippers are so busily employed that in many instances they are ordering new shipping tonnage, whilst in others new vessels are being built.

Wydale.—On November 21st the steamer *Wydale*, 1,870 tons, from Oran to Glasgow, with esparto grass, arrived in the harbour with her cargo on fire. A large staff of firemen were engaged all day endeavouring to extinguish the fire, but that work was only accomplished when the vessel sank. The damage to ship and cargo will probably amount to £6,000. A number of firemen were injured during the day.

GRIEVANCES OF YOUNG ENGINEERS.

PROFESSOR EWING voiced the grievances of many young engineers at a meeting held in the Senate House, at Cambridge, on Saturday afternoon, November 18th, under the presidency of the Vice-Chancellor, to form an Association for the employment of graduates of the University in the various professions and occupations for which they were fitted by their University training. He said they had an extraordinarily copious supply of men in the engineering department of the University. Year by year and term by term the stream of young men coming up to learn engineering continued to be increased. They endeavoured, with the very scanty resources at their disposal, to give these young men such a training as might be helpful to them in their professional life, and here, it might be said, that their responsibility ended. Still they could not see, without some sad anxiety, that little army, year by year swelling in numbers, going down after taking their degree, facing in its simplicity the entirely unknown world of practice. And, again, they could not help feeling that it would be well if the employers were aware what a large volume of excellent material was at their hands, only lacking a little practical experience to make it of first-rate utility. He thought an Appointments' Association would do much to foster both these ends. The young engineer when he left the University had to get some practical experience. He was sorry to say that generally he had to pay dearly for it; he had to pay for the privilege of giving his services gratuitously to his first employer often for three or four years. One thing the Association might very well set itself to do, and that was to endeavour to secure at the hands of engineers some better, some more reasonable terms, for the reception of young men into their works. He would like to see more in England of what they constantly saw in America—a graduate from the technical school being at once accepted as at least worth his bread and butter.

Then again, in the history of a young engineer, after this period of probation was passed, it often happened that he found himself entirely adrift. It was then, he hoped, he would again turn to the Association—he had probably kept his name on the books—and would look to it once more, as he would look to a qualified registry office, to put him in touch with an employer who wanted practical experience as well as scientific training. One often received letters of enquiry from employers, saying that they wanted a man with a scientific training and practical experience for such and such a post. Within the last week it had fallen to his lot to answer three such letters. With the best will in the world to find places for young men, it was by no means easy to answer such letters. The young man who answered the specified requirements had gone down two or three terms ago; one had lost touch with him; one did not know whether he wanted a place, and so it often happened that such letters had to go without any satisfactory response. All these were matters for this new Association. He thought employers would go to the Association, knowing that it would act the part of an honest broker, and that the men whom it recognised would at least have shown some guarantee of their qualities, some capacity for discharging the work that they were trained to do; and as regarded the engineer employers in particular, he thought they would turn their eyes more to the University than they had done in the past, they would do so to an increasing extent, and they would soon learn that men who came from the University with a sound scientific training made good engineers.

It was unanimously agreed, on the motion of Lord Rothschild, to form a University Appointment Association, and a strong board of management was appointed. Among those who wrote expressing sympathy with the objects of the movement were: Lord Loch, Sir John Lubbock, Mr. Hugh Bell, Messrs. Bell Bros., ironmongers, North of England, Mr. Yarrow, Sir Thomas Andrews, Mr. W. H. Allen, Queen's Engineering Works, Bedford, Mr. Noble, Britannia Works, Ilford, Mr. Kennie B. Murray, secretary of the London Chamber of Commerce, and many others.

The three ironclads just laid down by the Swedish Admiralty, and being constructed in Sweden, are to be provided with Yarrow boilers.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

British Prince.—On October 21st a finely-modelled steel twin-screw steamer was launched by Palmer's Shipbuilding and Iron Co., Limited, at Jarrow-on-Tyne, of the following dimensions:—Length between perpendiculars, 470 ft.; breadth, extreme, 56 ft. 6 in.; depth, moulded, 35 ft. The vessel will be rigged as a four-masted fore-and-aft schooner, and has been built under special survey to take the highest class in Lloyd's registry. She is of the three-deck type, with two steel decks laid all fore and aft, and has a closed in shelter deck, specially strengthened for the Atlantic trade, extending over the whole length, and above this a shade deck covering the machinery openings. All the available space under the shelter and shade decks is left clear for carrying horses. The hull is divided into ten watertight compartments by means of nine watertight steel bulkheads. The vessel will be lighted throughout by electricity, and will be fitted with all the most modern appliances for the rapid loading and discharging of cargo, and for the general working of the ship. The vessel is designed to carry upwards of 10,000 tons deadweight on about 27 ft. mean draught. The vessel has been constructed for the British Shipowners' Company of Liverpool, of whom Messrs. Gracie, Beazley & Co., are the managers. The christening ceremony was performed by Miss Winifred Barbara Jackson, daughter of the chairman of the British Shipowners' Company, who named the vessel *British Prince*.

Brunswick.—On October 21st there was launched from the shipbuilding yard of Messrs. John Jones & Sons, on the Mersey, the steel screw tugboat *Brunswick*, which has been built to the order of the Alexandra Towing Company, of Liverpool. This is the third vessel of the same type launched this year by Messrs. Jones for the same owners. The machinery in each case has been constructed by the builders.

Hawkwood.—On October 21st there was launched by Messrs. John Blumer & Co., at Sunderland, a screw steamer, built to the order of Mr. H. Cecil Polly, of London. The vessel is intended for the coasting coal trade. Engines will be fitted by Messrs. John Dickinson & Sons. The vessel was christened *Hawkwood* by Miss Catherine Swan, of South Shields, daughter of Captain Swan, who will take command.

Hesperides.—On October 21st there was launched by Messrs. Bartram & Sons, at Sunderland, a large steel screw steamer for Messrs. R. P. Houston & Co., Liverpool. The vessel is of the following dimensions:—Length, 365 ft.; breadth, 47 ft.; depth, 27 ft. 6 in., and has been built under special survey to take the highest class in Lloyd's registry. She is intended for Messrs. Houston's River Plate line, and has been specially designed by the senior partner, Mr. R. P. Houston, M.P., for the various requirements of the Plate trade.

Mora.—On October 21st there was launched at South Shields a steel schooner-rigged steamer of about 2,870 tons gross, named the *Mora*.

Robinia.—On October 21st there was launched at Grimsby for the North-Eastern Steam Fishing Co., Limited, Grimsby, an iron steam yawl, of about 185 tons gross, named the *Robinia*.

Waterloo.—On October 21st there was launched at Liverpool for the Alexandra Towing Co., Liverpool, a steel steam tug, of about 149 tons gross, named the *Waterloo*.

Steel Screw Steamer.—On October 21st there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer of the following dimensions:—Length, 335 ft. over all; breadth, 47 ft.; and depth, moulded, 25 ft. The vessel has a large deadweight capacity on a light draught. She has been built under special survey, and is classed 100 A1 at Lloyd's. Her engines, also built by Messrs. John Readhead & Sons, are of the triple-expansion type, having cylinders, 24 in., 40 in., and 64 in. by 45 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch.

St. George.—On October 25th there was launched at Hull for the Grimsby Victor Steam Fishing Co., Limited, Grimsby, a steel steam ketch, named the *St. George*.

Kilnsea.—On November 2nd Messrs. William Gray & Co., Limited, launched the large steel screw steamer *Kilnsea*, which they have built to the order of Messrs. William Brown, Atkinson & Co., Limited, of Hull, for the Sea Steamship Co., Limited. Her principal dimensions are:—Length, overall, 336 ft.; breadth, 47 ft.; and depth, 24 ft. 10 in., and she is built to Lloyd's highest class, with poop, bridge, and forecastle, and fore and aft schooner rig. Very tasteful cabin accommodation is provided in a large deck-house on the bridge. The engineers' rooms are also on the bridge, and the crew's berths forward. The hull is built with deep frames, and a cellular double bottom and after peak tank for water ballast. Steam windlass, steam-steering gear amidships, hand screw gear aft, six steam winches, and the whole of the outfit are of the most improved description. The engines are by the Central Marine Works of Messrs. William Gray & Co., Limited, on the triple-expansion system, with cylinders 24 in., 38 in., and 64 in. diameter, and 42 in. stroke, and three single-ended main boilers to work at 160 lbs. pressure per square inch. The ship and machinery have been built under the superintendence of J. Jamieson & Co. on behalf of the owners. The ceremony of naming the *Kilnsea* was gracefully performed by Mrs. Arthur Atkinson, of Elloughton. The following were also present at the launch, viz:—Mrs. Fenton, Mrs. S. Earle, Joseph Atkinson, J.P., Messrs. Arthur J. Atkinson and Edwin Fenton (Wm. Brown, Atkinson & Co., Limited), and Mr. Jenkins (principal of J. Jamieson & Co.), along with others.

Whakatane.—On November 3rd there was launched by Messrs. R. and W. Hawthorne, Leslie & Co., Limited, at Hebburn-on-Tyne, for the New Zealand Shipping Company, London, a large two-masted steel screw steamer. Her principal dimensions are:—Length over all, 435 ft.; breadth, 54 ft.; depth 40 ft. to shelter deck. She is the 17th of a series of nineteen vessels built and building by Messrs. Hawthorn, Leslie & Co., for the Australian and New Zealand frozen meat trade. The engines of the vessel have been built at the works of the firm and are of the triple-expansion surface-condensing type, with cylinders of 30 in., 48 in. and 78 in. diameter by 54 in. stroke. The vessel was named *Whakatane* by Mrs. Croucher, wife of Captain Croucher, who will command the vessel.

Southgate.—On November 4th there was launched by Messrs. T. Turnbull & Son, at Whitby, to the order of Messrs. Turnbull, Scott & Co., of London, a steel screw steamer of the following dimensions, viz.:—Length over all, 361 ft. 3 in.; length between perpendiculars, 350 ft.; breadth, extreme, 43 ft.; depth to top of ordinary floor, 28 ft. 6 in.; class 100 A1 spar-deck at Lloyd's, under special survey of hull and machinery; built of steel, with Web frames; water ballast tanks throughout holds, under engines, and in after peak. Messrs. Blair & Co. will supply direct-acting triple-expansion engines, having cylinders 24 in., 40 in., and 65 in., stroke 42 in. The vessel was named the *Southgate*, and will be commanded by Captain G. Thompson, late of the *Trongate*.

Thomas Leigh.—On November 4th there was launched at Maryport, for Mr. H. Podens, of Wismar, a steel schooner-rigged steamer, the *Thomas Leigh*, of about 791 tons gross.

Caucasian.—On November 4th this vessel, building to the order of Messrs. Lane & Macandrew, of London, by Messrs. Sir James Laing & Sons, Limited, Sunderland, was successfully launched. She is of the following dimensions:—Length, 365 ft.; breadth, 49 ft. 6 in.; moulded depth, 30 ft. 5 in., and will carry about 6,000 tons of petroleum in bulk, besides 800 tons of coal and the usual stores. The vessel is being constructed throughout to Lloyd's highest class and the Suez Canal regulations, under the personal supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. The engines, by Messrs. George Clark, Limited, will be fitted amidships, having cylinders 25½ in., 42 in., and 69 in., with 45 in. stroke, and will take steam from three large single-ended boilers at a pressure of 180 lbs. per square inch. Electric light will be fitted throughout the ship, and an elaborate pumping arrangement will be fitted to enable the cargo to be quickly discharged. Detailed auxiliary machinery will be fitted, including large donkey boiler. steam heaters, steam and hand steering gear, steam windlass, steam winches, warping winch, &c. The vessel goes to the engine yard to take her machinery.

Dacia.—On November 4th there was launched from the West Shipbuilding Yard of C. S. Swan & Hunter, Limited, a steel screw steamer which has been built to the order of Messrs. A. C. De Freitas & Co., of Hamburg. The leading dimensions of the vessel are:—Length overall, 346 ft.; beam, 48 ft.; and depth moulded, 34 ft. 9½ in. to the shelter deck. A shelter deck has been fitted right fore and aft, which can be used for either cattle or light cargo; all the accommodation for the officers and engineers being in houses on top of this deck, while that for the crew and firemen, is under the shelter deck forward. The machinery has been constructed by T. Richardson & Sons, Limited, of Hartlepool, and consists of a set of triple-expansion engines having cylinders 24 in., 39 in., and 66 in. diameter by 45 in. stroke, steam being supplied by two large single-ended boilers working at a pressure of 180 lbs. On leaving the ways the vessel was gracefully named the *Dacia* by Miss Hunter, of Jesmond.

Begonia.—On November 4th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Wellington Quay-on-Tyne, a steel screw steamer built to the order of the Stag Line, Limited, of North Shields, and of the following dimensions, viz.:—Length, 345 ft.; breadth, 46 ft.; depth, 27 ft. 2 in., moulded, and to class 100 A1 at Lloyd's on the spar deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including five double cylindered steam winches, direct acting steam windlass, large donkey boiler, steam steering gear by Messrs. Clarke, Chapman & Co., Limited, and Hastie's screw gear aft. The engines, which are to be supplied by the North Eastern Marine Engineering Co., Limited, are of the triple-expansion type, having cylinders 23 in., 38½ in., and 64 in. by 42 in. stroke, and working at a pressure of 180 lbs. On leaving the ways the vessel was named the *Begonia* by Miss Mabel Williamson, of South Shields. It is interesting to note that the vessel is the 18th built by the Tyne Iron Shipbuilding Co., Limited, and the engines the 28th set built by the North Eastern Marine Engineering Co., Limited, for the above owners.

Brenda.—On November 6th there was launched at Sunderland, for Messrs. Fenwick, Stobart & Co., a steel schooner-rigged steamer of about 1,146 tons, named the *Brenda*.

Lindsey.—On November 7th Messrs. Cochrane & Cooper launched at Selby for the Lindsey Steam Fishing Co., Limited, Grimsby, the steam trawler, *Lindsey*.

John H. Barry.—On Tuesday afternoon, November 7th, this vessel was launched from the Shipbuilding Yard of Messrs. Joseph L. Thompson & Sons, Limited, North Sands, Sunderland, and has been built to the order of Messrs. John H. Barry & Co., of Whitby, and is the 12th ship built by this firm for these owners. Her principal dimensions are:—Length, between perpendiculars, 320 ft.: breadth, extreme, 47 ft. 5 in.; depth moulded, 24 ft. 9 in. She is built to Lloyd's 100 A1 class under their special survey on the three-deck rule, but having only one deck laid right fore and aft. She has a poop and bridge amidships arranged for the stowage of cargo, the topgallant forecastle being fitted for the accommodation of seamen, firemen, and petty officers. The accommodation for the captain, saloon, spare berths, steward, engineers, and officers, &c., being in houses on top of the bridge deck. The deck machinery is of a powerful description, and consists of six steam winches, supplied with steam by a large multitubular donkey boiler working at 160 lbs. pressure. The steam steering gear is placed at the after end of the engine casings, connected by controlling gear to the steering house placed on top of the saloon house, a large chart-room also adjoins this steering house. A powerful screw gear is placed on the poop deck aft, and a patent steam windlass is fitted on the forecastle head, having all the latest improvements. The vessel has a cellular double bottom constructed for water ballast, which will also be carried in the after peak. Shifting boards are fitted longitudinally throughout the ship and six transverse watertight bulkheads are also fitted, and in addition the usual wood division bulkheads. The vessel is rigged as a two masted fore and aft schooner with telescopic topmasts. Four boats are placed on top of the accommodation amidships, and the vessel is supplied with all the latest improvements for the rapid handling of cargo, and for the complete equipment of modern vessels. The engines and boilers have been constructed by Messrs. John Dickinson & Sons, Limited, of the Palmer's Hill Engineering Works, Sunderland. The cylinders are:—23 in., 38 in., 62 in., having a stroke of 42 in., supplied with steam by two multitubular boilers working at 160 lbs. pressure. The hull and machinery have been constructed under the personal supervision of Mr. H. O. Barry, of Whitby, the managing owner. There was a numerous company present at the launch, the christening and launching ceremony being gracefully performed by Mrs. H. O. Barry. Mr. Phorson's patent launching trigger was used at this launch, and is used at every launch at this yard. Among the company present were:—Mrs. J. H. Barry, Mr. and Mrs. H. O. Barry, Mr. and Mrs. G. E. Barry, Mr. and Mrs. Robert Thompson, Mr. and Mrs. J. B. Jackson. Mr. and Mrs. J. Jackson, Miss Maccoy, Mrs. Clark, Mr. Cooper, Captain and Mrs. Jefferson, Miss Smalls, Mr. J. Suggit, Mr. J. K. Hill, Captain C. Vasey, Superintendant Pinkney, Mr. R. Pinkey, Mr. and Mrs. T. Metcalf, Mr. J. Marr, Mr. and Mrs. P. Phorson, &c. After the launch, which was most successful, the company adjourned to the firm's luncheon room, where the usual toasts were duly honoured.

Hornsea.—On November 8th there was launched at Hull, for the Hull Steam Fishing & Ice Co., Hull, an iron and steel steam ketch, named the *Hornsea*.

Skandia.—On November 16th Messrs. W. Doxford & Sons launched from their Pallion Yard, Sunderland, the large turret steamer *Skandia*, built for Messrs. W. Muller & Co., of Rotterdam. The dimensions of this vessel—the 54th turret steamer afloat—are: 405 ft. by 50 ft., by 28 ft. 6 in., and her deadweight capacity is 7,500 tons, on the comparatively small draught of 22 ft. The vessel is classed with the Bureau Veritas, and has been specially designed on somewhat novel lines to meet the requirements of the iron ore trade, in which the greatly concentrated weight of the cargo and the rapid loading and discharging of ore were the difficulties to be met by the designer of the vessel. Ample strength had been secured in the turret type of structure, and the *Skandia* is fitted with ten masts, five on each side of the ship, thus enabling no less than 18 derricks to be operated at once, and these, together with other special fittings, will very greatly expedite the shipment or discharge of large ore cargoes. She has been fitted with three boilers and engines, 25 in., 43 in., and 70 in., stroke, 45 in., also built by the same firm.

St. Gothard.—On November 16th there was launched by Messrs. J. T. Eltringham & Co., at South Shields, a steel screw trawler, 100 ft. 6 in. in length, 20 ft. broad, and 10 ft. 6 in. in depth, to be fitted with engines by Messrs. Baird & Barnsley, of North Shields. She was christened the *St. Gothard*, and is built to the order of Mr. Robert Hastie, of North Shields.

Drachenfels.—On November 16th Messrs. Wigham-Richardson & Co., Limited, launched from their Neptune Shipyard, Newcastle-on-Tyne, a large steel screw steamer which they are building to the order of the Deutsche Dampfschifffaharts Gesellschaft "Hansa," of Bremen. The steamer is for the Indian trade, and will carry 10,000 tons dead weight on a light draft of water. She will be fitted with quadruple expansion engines on the Yarrow, Schlick & Tweedy system, working at 210 lbs. pressure, which, together with the boilers, are being constructed by Messrs. Wigham-Richardson & Co., Limited. As the vessel left the ways she was named the *Drachenfels*, the christening ceremony being gracefully performed by Mrs. Newberry, of Tynemouth.

Helsingborg.—On November 16th, Messrs. William Gray & Co., Limited, launched a fine steel screw steamer which they have built to the order of the Rederiaktiebolaget Helsingborg (Mr. N. C. Corfitzon, manager). She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length overall, 312 ft.; breadth, 43 ft.; and depth, 22 ft. 3½ in.; with full poop, bridge, and top-gallant forecastle. The saloon and captain's rooms are under the poop, and the engineers' and officers' accommodation in houses on the bridge. The hull is built with deep bulb angle frames, cellular double-bottom, and aft peak tank for water ballast, six steam winches, steam-steering gear amidships, hand screw gear aft, patent quick warping steam windlass, patent donkey boiler, grain divisions, stockless anchors, and other improved appliances. Three cylinder triple-expansion engines of over 1,000 H.P., are being supplied by the Central Marine Engine Works, of Messrs. Wm. Gray & Co., Limited. The cylinders are—22 in., 35 in., and 59 in. diameter with a piston stroke of 39 in., and large steel boilers to work at a pressure of 160 lbs. per square inch. The ceremony of christening the steamer *Helsingborg*, was gracefully performed by Mrs. Wm. C. Borrowman, of West Hartlepool. The *Helsingborg* is the 600th ship launched by the builders.

Llanover.—On November 16th, Messrs. Richardson, Duck & Co., launched from their yard a steel screw steamer of the following dimensions, viz.;—Length overall, 351 ft. 9 in.; breadth, extreme, 48 ft.; depth, moulded, 28 ft. 4 in.; tonnage, gross, about 3,850 tons. This vessel which has been built to the order of Messrs. Evan Thomas, Radcliffe & Co., of Cardiff, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is a "single deck" steamer built to three deck rule, having poop, bridge extending from mainmast to foremast, and top gallant forecastle. Accommodation for captain and officers is provided in poop; engineers being berthed in iron side-houses on bridge deck; and crew in top gallant forecastle, which has been specially fitted with patent galvanized iron berths, and a bath-room. A cellular double-bottom all fore and aft, and fore and aft peak tanks are fitted for water ballast, and equipment includes six steam winches by R. Roger & Co., an auxiliary main boiler by Messrs. Blair & Co., of 160 lbs. working pressure, steam windlass, stockless anchors, steam steering gear, and all latest appliances for the economical and safe working of the vessel. The engines by Messrs. Blair & Co., have cylinders 25 in., 42 in., and 68 in. by 45 in. stroke, steam being supplied by two single-ended boilers of 160 lbs. working pressure. As the vessel left the ways she was christened *Llanover*, by Mrs. C. W. Elliott, of Stockton-on-Tees.

Eduard Bary.—On November 17th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 325 ft.; breadth, extreme, 48 ft.; depth, moulded, 24 ft. 3 in. The steamer has been built to the order of Messrs. Furness, Withy & Co., Limited, West Hartlepool, for Mr. H. J. Pallisen, of St Petersburg. The vessel is built on the three deck rule, with one deck laid, having full poop, long bridge, and top gallant forecastle. The saloon and cabins for the captain and officers will be fitted up in the poop, the accommodation for engineers under the bridge deck, and the crew will be berthed in the forecastle as usual. She has double bottom on the cellular principle for water ballast fore and aft, and in large after peak tank. The vessel will carry about 5,200 tons dead weight, on Lloyd's freeboard: is fitted with direct steam windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft, 5 large steam winches, supplied with steam from a horizontal multitubular donkey boiler, &c. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of about 1,100 I.H.P., steam being supplied by two steel boilers 15 ft. 3 in. by 10 ft. 3 in., their pressure being 160 lbs. per square inch. The christening ceremony was gracefully performed by Miss Casper, of Middlesbrough, who gave the vessel the name of *Eduard Bary*.

Freiburg.—On November 17th Messrs. Furness, Withy & Co., Limited, launched from their Middleton Shipyard, Hartlepool, a large steel screw steamer built to the order of Messrs. The Norddeutscher Lloyd, of Bremen, Germany. She is over 400 ft. in length, and built throughout of Seimen's-Martin steel, with a measurement capacity of 12,900 tons. The vessel is of the three deck type, with long poop and forecastle, and takes Lloyd's highest class. The holds are fitted for wood shifting boards, and all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel and iron. The greater portion of the plates are in 24 ft. lengths. Ten steam winches, donkey boiler, patent steam steering gear with hand-screw gear fitted aft, direct steam patent windlass, twelve derricks, six large cargo hatches, and other modern appliances are fitted for the handy working of the ship. The vessel is fitted with cellular double bottom all fore and aft, and the fore and after peaks are also available for water ballast. An extra number of bulkheads are fitted, making the vessel practically unsinkable in the event of collision. A large hold is fitted aft of the engine room for the carriage of camphor. The vessel will be lighted throughout by electricity, and the saloon and cabin for the accommodation of the captain and officers of the ship are handsomely fitted. She will be rigged as a two-masted fore-and-aft schooner. Triple expansion engines will be fitted by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, Middlesbrough, with cylinders 28 in., 44 in., 75 in., by 48 in. stroke; steam being supplied by two boilers 14 ft. long by 12 ft., and one 15 ft. 5 in. by 12 ft., working at a pressure of 180 lbs. Howden's forced draught will also be fitted. Messrs. Furness, Withy & Co., Limited, have a duplicate of this vessel now on the stocks, for the same owners. On leaving the ways the ceremony of christening the vessel *Freiburg* was gracefully performed by Miss E. Liessmann, of Bremen. Director Leist and other officials of the owners were present.

Daphne.—On November 18th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Limited, at Bill Quay, Newcastle-on-Tyne, a handsome steel screw steamer which has been built to the order of Mr. John. Bull, of Tonsberg, Norway. The vessel is of the long raised quarter-deck type, with short bridge and top gallant forecastle, and she will be rigged as a fore and aft schooner with telescopic topmasts. Her principal dimensions are as follows, viz.:—Length, 264 ft.; beam, 36 ft.; depth, moulded, 18 ft., and she is designed to carry about 2,300 tons dead weight on a light draught. The saloon, captain's accommodation, and spare berths are arranged in a large house on bridge deck amidships, with chart room on flying bridge above, the officers' accommodation being in houses on bridge deck on either side of vessel, whilst the crew are berthed in the top gallant forecastle. Water ballast is provided in the cellular double bottom, all fore and aft, and in the after peak. She will be fitted with the most modern description of deck machinery and other appliances for facilitating the rapid loading and discharging of cargo, and general working and navigating. The propelling machinery has been constructed and will be fitted by the North Eastern Marine Engineering Co., Limited, at their Northumberland Engine Works, Wallsend-on-Tyne, and will consist of a set of their triple-expansion engines of improved design, having cylinders 18½ in., 39 in., and 40 in. diameter respectively, with a stroke of 33 in., steam being supplied by a large steel multitubular boiler, working at a pressure of 160 lbs. per square inch. Both the ship and engines have been built to Norwegian Veritas highest class, and have been surveyed during construction by Mr. Lauritz M. Bodin, of Sunderland, the local representative, and by Captain Berg, of Christiania, who will take command. The christening ceremony was performed by Miss Dessen, daughter of Mr. Fred Dessen, of London, who named the vessel *Daphne*.

Cecil Rhodes.—On November 18th there was launched by Messrs. Forrestt & Sons, at Wyvenhoe, the steamship *Cecil Rhodes*, built for the Tanganyika Concessions, Limited. The new vessel, which will be the first iron steamer to ply on the waters of Lake Tanganyika, is to be employed primarily in laying the wires of the Cape to Cairo telegraph line along the shore of the lake. The hull and the engines have been so constructed that they can be taken to pieces and packed into small parcels of about 40 lbs. each for transport. The dimensions of the *Cecil Rhodes* are:—Length, 80 ft.; beam, 14 ft.; depth, 7 ft. She is built of galvanised Siemens-Martins steel, and will carry a load of 40 tons on light draught. The machinery, which has been supplied by Messrs. Mumford, of Colchester, is of the compound, surface condensing type, after the latest Admiralty pattern. The boilers are water-tube, and the vessel is driven by twin-screw propellers.

Eva.—On November 18th Messrs. Wm. Gray & Co., Limited, launched the large side ballast tank steamer *Eva*, which they have built to the order of Mr. M. Jebsen, of Hamburg. The *Eva* is similar to the *Mancunia*, *Claudius*, and *Wearside*, the first side tankers by the same builders. In all these vessels when in ballast the beneficial effects of the side tanks have been very considerable; the speed and behaviour of the ships have been highly satisfactory, the racing of the machinery much less than usual. By this system efficient ballasting under easy control is provided without the cost and inconvenience of having to ship rubbish ballast. The *Eva* is built to Lloyd's highest class. Her dimensions are:—Length over all, 350 ft.; breadth, 51 ft.; depth, 27 ft.; deadweight capacity, 6,200 tons, with large measurement capacity and deck area for cattle or timber, etc. The arrangements throughout the ship, including a special outfit of steam winches, derricks, etc., will enable cargo to be dealt with most expeditiously. A cellular double-bottom extends throughout, and after peak tank for water ballast, whilst the side tanks contain an additional 720 tons of water ballast. The side tanks (McGlashan's) extend through the main and after holds and engine-room for a length of 191 ft., in way of which the ship has double sides, adding greatly to her strength and also to her safety. These advantages are secured without extra material being required in the construction of the side tanks, lower decks and other parts used in strengthening ordinary ships, and which greatly impede stowage, being dispensed with so that the new type loses nothing as a cargo carrier. The machinery consists of a fine set of triple-expansion engines of over 1,400 H.P., having cylinders 25½ in., 40½ in., and 67 in. diameter, and 45 in. piston stroke, with three main boilers to work at a pressure of 170 lbs. per square inch, all by the Central Marine Engine Works of the builders. Mr. P. H. Bahnsen has superintended the building of the ship on behalf of the owners, and the ceremony of christening the *Eva* was gracefully performed by Miss Frieda Bahnsen of West Hartlepool.

Macedonia.—On November 18th, Messrs. Craig, Taylor & Co., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, the second of two very fine steel screw steamers which they have lately had under construction for Messrs. A. C. de Freita's & Co., Hamburg. The dimensions are 274 ft. by 35 ft. by 23 ft. 8 in. moulded. She is of the spar deck type, to Lloyd's highest class. She has been built on the deep frame principle, and has poop, bridge, and top gallant forecastle, the bows being specially strengthened for ice. She has water ballast in double bottom fore and aft, and in peaks, and is fitted with patent steam windlass, patent steam steering gear, four steam winches, extra large donkey boiler, screw gear aft, and all the latest improvements. Triple expansion engines by Messrs. Thomas Richardson & Son, Limited, Hartlepool, are being supplied, of the following dimensions, 22 in., 35 in., 59 in., by 39 in. stroke, two steel boilers working at 160 lbs. pressure. The ship and engines have been built under the superintendence of Mr. Heinr. Wiengreen and Mr. M. Rother. As the vessel left the ways, she was gracefully christened the *Macedonia*, by Mrs. M. B. Dodds, wife of the town clerk of Stockton. The lady, on performing the ceremony. was presented with a bouquet and holder by Master George Butt Craig, while Captain G. Cantieny, representing the owners, presented a handsome gold bracelet suitably inscribed.

Manchester Shipper.—On November 18th there was launched from the yard of Messrs. Irvine's Ship Building and Dry Docks Co., Limited, at West Hartlepool, a finely modelled steel screw cattle and cargo steamer named the *Manchester Shipper*, built to the order of the Manchester Liners Limited, of which Sir Christopher Furness is chairman. The vessel is being built expressly for the Manchester Liners' Service from the Manchester Ship Canal to Canada, and has a cargo capacity of 10,666 tons. She is of the following dimensions, viz:—Length, 382 ft.; breadth, 48 ft.; and depth, 36½ ft. She has two masts and is rigged fore-and-aft with telescopic topmasts to suit the Manchester Canal bridges, and has been built under special survey to take the highest class in Lloyd's Registry. She is built to the highest grade with one steel deck, and has an iron shelter deck specially strengthened considerably in excess of Lloyd's requirements for the Atlantic trade extending over the whole length and above this is a bridge deck 110 ft. long. All the available space under the shelter deck and along each side under the bridge deck is fitted throughout to pass the American and Canadian regulations, with the most approved and modern arrangements for carrying about 500 head of cattle. The accommodation for saloon, captain and spare state-rooms, &c., is arranged on the bridge-deck, in a large steel deckhouse, with separate houses for officers and engineers, while the seamen and firemen are berthed under the shelter-deck forward, the cattlemen's quarters being under the shelter-deck aft. A cellular double bottom is fitted all fore and aft for water ballast and also four separate tanks under engine and boiler space for fresh water for supplying cattle. Water ballast is also arranged to be carried in a deep cargo tank and in the after peak giving the vessel a total water ballast capacity of over 1,600 tons. The vessel is divided into six water-tight compartments by means of seven steel bulkheads, all of which extend to the upper deck. Each compartment is fitted with complete iron and wood grain divisions. A most complete system of ventilation has been arranged to ensure the safe carriage of cattle, grain or other cargoes. The vessel has six hatches, eight powerful steam winches, and twelve derricks provided for the rapid loading and discharging of cargoes. A powerful steam windlass is fitted forward for working the cables and a combined hand and steam steering gear, of special design, is fitted in a large steel wheelhouse on the after-end of the shelter-deck. Special steering telegraphs are fitted for navigating purposes whilst going up the canal. The vessel is lighted throughout by electricity, and is fitted as a first-class cargo steamer, including all the most modern improvements for the Atlantic trade. The engines are being constructed by Messrs. William Allan & Co., Limited, of Sunderland, and are of the inverted triple expansion type, having cylinders 25 in., 41 in. and 69 in. in diameter by 48 in. stroke, steam being supplied by three single ended boilers 14 ft. 3 in. in diameter by 11 ft. long with a working pressure of 180 lbs. All the shafting is very considerably in excess of Lloyd's requirements. The auxiliary machinery is of the most modern type. As the vessel left the ways the christening ceremony was gracefully performed by Mrs. Stephen W. Furness. She has been specially designed and built for the Manchester Canal trade, under the supervision of Mr. A. H. Walker, shipbuilding superintendent for Sir Christopher Furness, and also Mr. T. M. Greenip, Marine Superintendent for the Manchester Liners, Limited. There was a large company present to witness the launch, including Mr. and Mrs. S. W. Furness, Major D. G. and Mrs. Irvine, Mr. W. C. Gray, Mr. and Mrs. Chas. Cooper, Mr. and Mrs. Kinch, Miss Furness, Mr. Chalton, Miss Purdon and others.

Penrith Castle.—On November 18th Messrs. Wm. Pickersgill & Sons launched from their shipbuilding yard at Southwick a finely modelled steel screw steamer, built to the order of Messrs. The Lancashire Steamship Co., Limited, of Liverpool, of which Messrs. Jas. Chambers & Co. are the managers. This is the seventh steamer built for the same owners, and her dimensions are:—Length, 371 ft.; breadth, 46 ft. 3 in.; and depth, 28 ft. 2 in. She has been built under special survey to take Lloyd's highest class as a spar deck steamer. The vessel is built on the deep frame principle, and fitted with cellular double bottom throughout for water ballast, in addition to which the after and fore peaks are fitted as tanks, and a large deep chamber tank is also being constructed abaft engine room with a view of enabling the vessel to go on long voyages in ballast, if necessary, with increased safety. The scantlings of the vessel have been considerably increased above Lloyd's spar deck rules to enable her to claim what is practically a three-deck freeboard, which will allow of her carrying a large deadweight cargo on a moderate draught. She has also been fitted with an extra long bridge, extending over nearly 200 ft. amidships, and completely covering the two main hatches, which will materially increase her measurement capacity in the case of light cargoes, and her other erections consist of a poop and forecastle. The whole of the erections are made 8 ft. high, and the bridge is fitted throughout with sidelights. also four cattle doors are provided in bridge sides, and the ventilation of the erections has been considerably increased, so that, if occasion should require, the vessel may, in a very short space of time, be fitted up for the carrying of cattle. The vessel has been specially designed with a view to rapid and efficient loading and discharging of cargo, and for this purpose she is provided with six large cargo hatchways, each of which is fitted with double derricks capable of raising heavy weights, large derrick posts being fitted for this purpose where necessary, and the ventilation of all cargo holds has been specially attended to, four large ventilators being fitted to each hold. She will be finished and equipped in a thoroughly efficient manner with all the latest appliances necessary to the outfit of a first-class modern cargo steamer. The vessel will be rigged as a two-masted fore and aft schooner, with steel lower masts and wood telescopic topmasts, and her eight steam winches will be supplied by Messrs. Clarke, Chapman & Co., while a special quick warping windlass will be fitted by Messrs. Emerson, Walker & Thompson Bros., and a large steam steering gear, by Messrs Lynn & Co., is fitted in house amidships abaft engine room, and controlled from bridge by means of rods and bevelled wheels. The donkey boiler for supplying steam to deck range will be made by Messrs. Riley Bros. A large steel deckhouse is fitted on bridge deck for the accommodation of the officers, with a large messroom tastefully fitted out in oak, while the captain is berthed in a steel house above, alongside the chartroom. The engineers accommodation is built in steel houses alongside engine casing on bridge deck, where rooms are also provided for apprentices. The seamen and firemen are berthed in topgallant forecastle, where there are also berths and messroom for the petty officers. The machinery and boilers are being supplied and fitted by Messrs. George Clark, Limited, of Southwick, the engines being of the triple-expansion type, having cylinders 24 in., 40 in., and 67 in. diameter, and a stroke of 45 in., and two large steel boilers with a working pressure of 180 lbs., fitted with "Howden's" forced draught. The ballast donkey arrangements have also been considerably increased to enable the large quantity of water ballast to be efficiently dealt with. During construction the vessel and engines have been under the personal supervision of Mr. E. H. Bushell and Mr. G. Kennaugh, of Liverpool, and she will be completed under the superintendence of Captain Lewis, who will take command. The vessel was named *Penrith Castle* on leaving the ways, and she immediately proceeded to Clark's engine works to receive her machinery.

Strombus.—On November 18th this vessel, which has been built to the order of Messrs. M. Samuel & Co., of London, by Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited, of Newcastle-on Tyne, was successfully launched from the builders' yard at Walker. The vessel is intended for the Eastern oil trade, and special attention has been given to this fact in the preparation of specifications and during construction. The principal dimensions are:—Length between perpendiculars, 410 ft.; beam, 52 ft.; depth moulded, 33 ft. 9 in., for total deadweight capacity of 8,450 tons. She has been constructed throughout to Lloyd's highest class, and to comply with the Suez Canal regulations for bulk oil carrying and general cargo steamers, under the immediate supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. There is a powerful pumping installation for the rapid discharge of the liquid cargoes, and extensive arrangements have been made to facilitate prompt loading and discharging of general cargoes, including the fitting of powerful steam winches and derrick gear of the latest type. The whole of the forward part of the vessel is reserved for cargo space, the engine accommodation for the engineer officers being aft, that of the captain and deck officers in the bridge, the crew being housed in spacious forecastle forward. The main engines are being built by Messrs. The North-Eastern Marine Engineering Co., of Wallsend, and have cylinders 28 in., 44 in., and 77 in. diameter, with a 48-in. stroke, taking steam at a working pressure of 180 lbs. per square inch from three large single-ended boilers. The auxiliary machinery includes, besides that mentioned above, steam steering gear, steam windlass and capstan, steam heaters, evaporators and feed filters, steam ash hoist and powerful marine type donkey boiler. Like many of the vessels belonging to Messrs. M. Samuel & Co., this steamer will be fitted for the burning of liquid fuel, and every arrangement for this has been provided. As the vessel left the ways she was gracefully named *Strombus* by Lady Samuel.

Brough.—On November 20th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions: 117 ft. 4 in. by 21 ft. 6 in. by 11 ft. 3 in. depth of hold, built to the order of Mr. J. H. Collinson, of Hull. Messrs. C. D. Holmes & Co., Hull, are fitting engines of the triple expansion type, all the most modern appliances for trawling will be fitted, and the vessel completed ready for sea. In the presence of a large number of visitors from Hull and district Mrs. T. B. Hodgson, of Beverley, named the vessel s.s. *Brough*. After the ceremony the company adjourned to the offices of the builders, where luncheon was provided.

LAUNCHES—Scotch.

Ravenscraig.—On October 18th there was launched at Dundee, for Mr. W. H. H. Hutchinson, Kirkcaldy, a steel schooner-rigged steamer, of about 830 tons gross, named the *Ravenscraig*.

Adriatico.—On October 20th there was launched at Port-Glasgow, for Eredi C. Cav. Gerolimich & Co., Lussinpiccolo, a steel schooner-rigged steamer, of about 3,618 tons gross, named the *Adriatico*.

Heros.—On October 21st there was launched by Messrs. A. Rodger & Co., at Port-Glasgow, a steel screw steamer to the order of Messrs. G. W. Snellman & Co., Kristinestad, Finland. Dimensions:—Length, 314 ft.; breadth, 44 ft.; depth, 23 ft. 3 in., moulded. The steamer registers 2,560 tons gross, and will carry 4,350 tons deadweight. The machinery will be supplied by Messrs. Hall-Brown, Buttery & Co., Glasgow. The ceremony of naming the steamer *Heros* was performed by Miss Rodger, Glenpark, Port-Glasgow. The steamer was superintended during construction by Captain Snellman, who will command.

Humber.—On October 21st there was launched at Ardrossan, for Mr. E. P. Hutchinson, of Hull, a steel schooner-rigged steamer of about 280 tons gross, named the *Humber*.

Donside.—On October 23rd there was launched at Aberdeen, for Mr. G. Fyfe, Aberdeen, a steel steam ketch of about 182 tons gross, named the *Donside*.

Puffin.—On October 23rd there was launched at Rutherglen, for the Manchester and Liverpool Transport Co., Limited, Manchester, a steel steam cutter of about 241 tons gross, named the *Puffin*.

Twin Screw Steamer.—On November 1st there was launched from the yard of Messrs. Ramage & Ferguson, Limited, Leith, a twin screw steamer for the African Boating Co., Limited, of Durban, Natal, contracted for by Messrs. Donald Currie & Co., London. The vessel will be ready to leave Leith about the first week in December. The launching ceremony was performed by Mrs. Ramage, The Hawthorns, Leith, and the owners were represented by Messrs. Munn, Ritchie & Tait.

Speedwell.—On November 3rd Messrs. Hawthorns & Co., Limited, launched at Leith the second of two beautifully-modelled steel screw steamer carriers of the following dimensions:—Length between perpendiculars, 140 ft.; breadth, moulded, 22 ft. 3 in.; depth, moulded, 11 ft. 8 in. She will be fitted out by the builders with triple-expansion engines, having cylinders 13 in., 22 in., and 37 in. diameter by 27 in. stroke, working at a boiler pressure of 200 lbs. per square inch. The hull and machinery have been constructed to the highest class at Lloyd's, and as the vessel left the ways she was named *Speedwell* by Miss M. Leyman, daughter of the chairman of the Great Northern Steamship Fishing Co., Limited, Hull, for whom the vessel has been built.

Gresham.—On November 6th Messrs. Taylor & Mitchell launched at Greenock a steel screw steamer for London owners, of the following dimensions:—Length, 185 ft.; breadth, 29 ft.; depth, 14 ft., moulded. The vessel will be furnished by Messrs. M'Kie & Baxter, Govan, with triple-expansion engines, the diameter of the cylinders being 15 in., 25 in., and 40 in., with a piston stroke of 27 in. The steamer, which is built to Lloyd's highest class, was named *Gresham* by Mrs. George Proven, whose husband superintended the construction of the vessel.

Steel Screw Steamer.—On November 6th Messrs. Robert Duncan & Co., Limited, launched at Port-Glasgow a single-deck steel screw steamer (a repeat of the steamship *Spartan Chief*), built to the order of Mr. T. B. Stott, Liverpool. Dimensions:—Length, 235 ft.; breadth, 34 ft. 6in.; depth, 18 ft. 9 in., moulded. The steamer will carry 2,000 tons deadweight. The engines are to be supplied by Messrs. Hall Brown, Buttery & Co., Govan; cylinders, 18½ in., 30 in., and 49 in., by 33 in. stroke. The steamer is designed and arranged for the Baltic and timber trades, and her construction was superintended by Mr. George S. Horne, Glasgow.

Croham.—On November 9th Messrs. William Hamilton & Co. launched from their Glen Yard, Port-Glasgow, a steel screw-steamer for Messrs. Houlder, Middleton & Co., London. The vessel has been specially built for their Eastern trade. The following are the principal dimensions:—Length between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in., with poop, long bridge amidships, and topgallant forecastle, and is classed at Lloyd's 100 A1. She is designed to carry over 5,400 tons deadweight on a light draught, with a net register tonnage of about 2,100 tons. A feature in this vessel's construction is the joggling of the shell, deck, and tank top plating, thus bringing all the strakes of plating close to the frames and beams without the use of filling slips. The propelling machinery, which is being supplied by Messrs. David Rowan & Co., of Glasgow, consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 65 in. diameter, respectively by 42 in. stroke; steam is supplied by two large boilers constructed for a pressure of 180 lbs. As the vessel left the ways she was named the *Croham* by Miss May Harvey, of Benclutha, Port-Glasgow. The owners were represented by Mr. Satchell, who has superintended the construction of the vessel. Immediately after the launch the vessel proceeded to Glasgow to receive her machinery.

Ethelinda.—On November 9th Messrs. Cochran & Co., Birkenhead and Annan, launched the first steamboat ever built at Annan, when they placed in the water a steam launch which they have built to the order of the Empreza Nacional Co., Lisbon, for one of their Royal Mail Line of steamers to the South African possessions of Portugal. A select company was present at the ceremony, and as the vessel glided down the way she was named the *Ethelinda* by Miss Ethel Forrest, niece of Mr. John T. Cochran, senior partner.

Jurua.—On November 10th there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a steel twin screw steamer built for passenger and cargo service on the river Amazon. On leaving the ways the vessel was named *Jurua*. Messrs. Jno. G. Kincaid & Co., Greenock, will supply the machinery.

Von Podbielski.—On November 10th, Messrs. David J. Dunlop & Co., engineers and shipbuilders, Inch Works, Port-Glasgow, launched a steel twin-screw cable steamer built by them to the order of the Norddeutsche Sukabelwerke Co., of Cologne. This new steamer has been specially designed for cable laying and repairing purposes, and all the details of her arrangements and construction have received the most careful consideration at the hands of the owners and builders, with a view to fulfilling satisfactorily all the requirements of the service in which she is to be more particularly employed. The following is a description of the steamer and her arrangements. Principal dimensions: Length, between perpendiculars, 255 ft.; Breadth, moulded, 35 ft.; depth moulded to underside of main deck, 16 ft.; depth moulded to under side of spar deck, 23 ft. 6 in. Classification, &c. The vessel has been constructed under the rules of Germanischer Lloyd to obtain their highest class (100 A 4) in steel as a spar deck steamer, and when fully equipped for sea has a deadweight carrying capacity of about 1,300 tons on 16 ft. 6 in. draught of water. The speed of the steamer when laden with 500 tons deadweight will be 13 knots per hour on the trial trip. The *Von Podbielski* has a cutwater stem and elliptical stern, the paying out and picking up gear fitted on stem and stern being so arranged as to reduce as far as possible the rubbing of the cable on the hull when it is handled. The upper deck is flush all fore and-aft, giving an unobstructed lead from the different cable tanks to the picking up and paying out machines at the bow and stern. The rig of the steamer is that of a two masted fore-and-aft schooner, the masts being of steel, and at each mast is provided a suitable steam winch, with all appliances for working, the derrick when handling buoys, grapnels, &c. The spar deck is of teakwood, and main deck is of pitch pine. The tween-decks accommodate all the necessary hands for working the steamer efficiently, and the after portion is fitted for the cable officers, and includes a well-apportioned and handsome saloon in hardwood, french polished, and spacious staterooms. The entrance to the cable officers apartments is approached from a large steel deckhouse having a double-way stair. A teak ornamental skylight gives light and ventilation to the saloon, and an electric driven fan is provided for specially ventilating these quarters. The alleyways alongside the engine and boiler space are suitably arranged for the accommodation of the navigating officers and marine engineers, with all the necessary conveniences and sanitary appliance. Forward of the boiler room bulkhead in tween decks, for a distance of 64 ft., accommodation is provided for all the cable hands, with a large testing room for electrician, workshops, staterooms, &c. The quarters for seamen and firemen are placed abaft the collision bulkhead, and are suitably fitted up with a view to ensure the utmost comfort. The cable machinery which has been supplied by Messrs. Johnson & Phillips, of Old Charlton, London, is of the most modern description, and the main forward portion comprising engines and picking up gear occupies the space between the crew's quarters and the rooms for cable hands on main deck. On the spar deck forward of boiler casing, a large house is fitted up, the after part containing a steam steering gear by Messrs. Alley & McLellan, and the fore part a large room for the chief navigating officers. Overhead is built the flying bridge, in which is placed the chart and wheelhouse. The cable tanks are three in number, first and second being arranged forward, and third one aft, each having cones in centre 6 ft. diameter at bottom, and 3 ft. 6 in. at top. The capacity of the tanks being about 20,500 cubic feet. Deep water ballast trimming tanks are fitted on the McIntyre principle, the tops of which form the bottoms of cable tanks, in the forward and after holds, having a capacity of about 300 tons. The pumping arrangements for all the several compartments being of the most approved and efficient description. The outfit of the steamer includes a patent direct steam capstan windlass by Emerson, Walker, & Thomson, six boats complete to Seeberufsgenossenschaft requirements; hawsers, anchors, and chains, to the requirements of Germanischer Lloyd. Complete installation of electric light by Messrs. Wm. Harvie & Co., together with an Admiralty type, 20 in. projector, and all the customary modern appliances for a steamer of this description. A large ice house is fitted up aft complete. The nautical instruments include a Lord Kelvin's Standard Compass, and steering and engine room telegraphs. The propelling machinery consists of two sets of triple expansion surface-condensing engines, having cylinders 17 in., 28½ in., and 47 in. diameter, by 33 in. length of stroke, each engine being fitted with Edwards air pump, and separate centrifugal pump for circulating water through condensers. The feed pumps and feed heaters are by Messrs. G. & J. Weir, with all the latest improvements. Davie's patent feed filter and evaporator. The propellers are loose blades, having cast iron bosses, with four bronze blades bolted on, steam is supplied by two large single ended boilers, 15 ft. 9 in. diameter, by 10 ft. 9 in. long, each having three furnaces of Deighton's patent, all proportioned for a working pressure of 180 lbs. per square inch, separate funnel to each boiler. A large donkey boiler, Cochrane's Patent, is fitted to work auxiliary machinery when vessel is in port. The machinery as well as the hull, has been erected under Germanischer Lloyd survey, to obtain the highest certificate. The ceremony of christening the steamer *Von Podbielski*, was gracefully performed by Miss Forde, sister of the submarine cable superintendent for the Company. A large number of guests assembled in the model room, when the various toasts were proposed and responded to. The owners were represented by Mr. Diederick and Mr. Guillaume.

Strathmore and **Strathbraan.**—On November 16th Messrs. Hall, Russell, & Co. Limited, launched at Aberdeen two steam trawlers named respectively *Strathmore* and *Strathbraan*. They have been built to the order of the Aberdeen Steam Trawling and Fishing Co. Limited, of which Bailie Brown is manager. The dimensions are:—Length, 109 ft.; breadth, 21 ft. 6 in.; depth 12 ft.; gross tonnage, 160 tons. The vessels are constructed of steel and classed 100 A1 at Lloyds, and will be fitted with steel boilers and triple-expansion engines of 320 I.H.P.

Drumblair.—On November 18th there was launched by Messrs. J. Duthie & Co., at Aberdeen, a steam trawler named the *Drumblair*, being the first of two screw vessels for the Aberdeen and North of Scotland Steam Fishing Co., Limited. The *Drumblair* is 124 ft. long over all, having a beam of 21 ft. 6 in., and a moulded depth of 12 ft. She will be furnished with triple-expansion engines by Messrs. Morton, of Leith.

Lune.—On November 18th, Messrs. J. Duthie & Co., launched at Aberdeen, the trawler *Lune*, one of four vessels ordered by the Palatine Steam Fishing Co., Grimsby. The *Lune* is 120 ft. long over all; 20 ft. 6 in. breadth; and 11 ft. 6 in. deep. She will be engined by Messrs. Tindal, of Hull.

Quarnero.—On November 20th, Messrs. Russell & Co., launched at Port Glasgow, a large steamer of the spar-deck type for Messrs. Eredi C. Cav. Gerolimich & Co., Lussinpiccolo (Dalmatia). The dimensions are:—Length, 331 ft.; breadth, 48 ft.; depth, 26 ft.; to carry 5,500 tons on Board of Trade summer free-board. Messrs. Kincaird & Co., Greenock, will supply engines, the cylinders being 24 in., 40 in., and 65 in. by 42 in. stroke. The steamer was named *Quarnero*.

Edith.—On November 21st, Messrs. Scott & Sons, launched from their Shipbuilding yard at Bowling, a screw steamer of the following dimensions, viz.:—100 ft. by 23 ft. by 11 ft. 4 in., moulded, which they have built to the order of Messrs. Joseph Monks & Co., Limited, Warrington. Compound surface-condensing engines are to be fitted on board by Messrs. Fisher & Co., Paisley. On moving down the ways the vessel was named *Edith* by Mrs. Alfred Howard, of Warrington.

Lake Erie.—On November 21st Messrs. Barclay, Curle & Co., Limited, launched from their shipbuilding yard at Whiteinch, on the Clyde, a steel twin-screw steamer, built to the order of Messrs. Elder, Dempster & Co., of Liverpool, for mail and general service between the United Kingdom and Canada, being commissioned by the Dominion of Canada for the carriage of the Canadian mails. The vessel's dimensions are—465 ft. by 53 ft. by 30 ft. 7 in. to shelter deck, with a gross tonnage of 6,500 and a deadweight of nearly 8,000 tons. She has been built to class 100 A1 at Lloyd's on the three-deck rule, with additional stiffening over rules to meet the requirements of the North Atlantic trade. She has three complete steel decks and a shade deck amidships. Water ballast is carried in a double bottom all fore and aft and in after peak. In addition there is a large hold water-ballast tank abaft engine-room, having a capacity of 1,000 tons, for trimming purposes when the vessel is running light. The passenger accommodation is fitted amidships, under shade deck, ample provision being made for about 100 first-class passengers, who will be berthed in large and handsomely furnished staterooms. The public rooms are commodious, and upholstered in excellent taste, and include dining-saloon, smokeroom, ladies' boudoir, lounge, &c. There is also accommodation for about 80 second-class passengers, who are provided with large and airy staterooms, separate dining-saloon, smokeroom, &c., complete. Accommodation is also provided for about 500 emigrants on main deck forward; the quarters are large, well lighted and ventilated, and the fittings of the newest style. A large recreation room, about 150 ft. long, is specially reserved for emigrants' use, and is a special feature in this vessel. The vessel is lighted throughout by electricity. The lower 'tween decks aft are insulated, and a powerful refrigerator is fitted up by the Linde British Refrigeration Co., Limited, London. Steam fire-extinguishers are supplied to each hold, and every precaution has been taken to ensure the safety of the passengers. The vessel is specially adapted for the carrying of troops and munitions of war; and, if necessary, horses and cattle can be carried all fore and aft, special portable fittings having been arranged for that purpose, The ventilation of the ship is exceptionally treated for the special purpose of the trade. The vessel is rigged as a fore and aft schooner, with four masts, and will present a very smart and handsome appearance when completed. The arrangements for the rapid loading and discharging of cargo are of the most complete and up-to-date kind, and include 12 powerful steam winches, steam windlass, steam-steering gear, fitted directly over the rudder-head. On leaving the ways the vessel was named *Lake Erie* by Mrs. W. R. Ferguson, Kelvinside, Glasgow. After the launch, the vessel was towed to the harbour to be fitted with her machinery, which is being supplied by the builders, and consists of two sets of triple-expansion twin-screw engines of 2,000 I.H.P. The diameter of the cylinders is 22 in., 37½ in., and 60 in., with a stroke of 4 ft., the steam being supplied by three large double-ended boilers of ample steaming power, working at a pressure of 180 lbs. per square inch. The engines are strong and substantially made. In addition to the main engines there are two electric light engines, refrigerator engines for cold meat chambers, two of Gwynne's centrifugal circulating pumps, Weir's pumps, evaporators, and heaters, Carruthers's donkey engines and ballast pump, three of Quiggin's distilling condensers, capable of making large quantities of fresh water for passengers and cattle, and the feed-water before going into the boilers is purified by one of Railton & Campbell's feed filters.

Finnieston.—On November 22nd Messrs. Fleming & Fergusson launched from their yard at Paisley the new cross ferry steamer to be used on the Clyde at Finnieston. The vessel, which has been fitted with elevating decks, is suitable for carrying both vehicular and passenger traffic. The elvated decks are so constructed that, by means of steam power, they will be adjustable to the rise and fall of the tide, and will therefore be at all times on a level with the quay walls. The vessel was named the *Finnieston* by Lady Richmond.

Itaura.—On November 22nd Messrs. W. Denny & Brothers, Dumbarton, launched a steel screw-steamer of the following dimensions:—410 ft. by 50 ft. 6 in. by 32 ft., and of 5,300 tons gross register. The vessel is to the highest class at Lloyd's, and has been built to the order of the British India Steam Navigation Co., Limited. On leaving the ways it was named the *Itaura*, the launching ceremony being performed by Mrs. Whitehead, wife of the captain of the ship.

Devolant.—On November 22nd Messrs. Wm. Simons & Co., Limited, Renfrew, launched successfully from their yard the dredger *Devolant*, which is believed to be the most powerful barge-loading dredger afloat. This vessel has been constructed to the order of the Russian Government, and is intended to work at one of the ports on the Black Sea. The dredger was launched with engines, boilers, dredging gear, including buckets, &c., fitted complete on board and ready for work. One pair of powerful compound surface-condensing engines of sufficient power to dredge about 2,000 tons per hour. The buckets each have a capacity of fully 35 cubic ft., or almost equal to two tons, and are the largest yet constructed by Wm. Simons & Co.. Limited. The main engines are also arranged to propel the dredger at a speed of seven knots. Besides the main boilers, an auxiliary boiler is fitted to drive the auxiliary machinery when under repairs. A machine room and repairing shop is fitted on board with lathes, drilling and planing machines, &c. The vessel is fitted with electric light throughout, and on deck large lamps are placed to enable dredging operations to be carried out day and night. The winches at both ends of the vessel are of very strong construction, and are worked by independent engines. The bucket ladder, which, with its chains of buckets weighs over 100 tons, excluding dredgings, is also controlled by a powerful set of independent engines. This dredger will, in a few days after trials, proceed to the Black Sea.

Hope and **Rapid.**—On November 25th there were launched at Irvine, by the Irvine Shipbuilding and Engineering Co, Limited, two steel screw steam trawlers to the order of the Peterhead Trawling Co., Limited, Peterhead. The vessels are built to Lloyd's highest class, under special survey, and are fitted with all the latest appliances for trawl fishing. They are of the following dimensions:—117 ft., between perpendiculars, by 21 ft., by 11 ft. 9 in. moulded, and are being supplied by W. V. V, Lidgerwood, Coatbridge, with triple-expansion engines of about 400 I.H.P., having cylinders, 12 in., 19½ in., and 32 in. by 22 in. stroke, steam being supplied from a large steel boiler working at 180 lbs. pressure. The one vessel was named *Hope* by Mrs. Leask, wife of Provost Leask, Peterhead; and the other *Rapid* by Mrs. Mitchell, wife of Ex-Bailie Mitchell, Peterhead.

Caledonia I.—Lately there was launched at Aberdeen, for Messrs. Young & Jameson, of Aberdeen, a steel steam ketch, of about 190 tons gross, named the *Caledonia I.*

LAUNCHES—Irish.

Galeka.—On October 21st. there was launched at Belfast, by Messrs. Harland & Wolff, to the order of the Union Steamship Co., the steamship *Galeka*, which is similar in design to the other vessels known as the "G's" already running in the Union Line, but somewhat larger than the first "G's," being a sister ship to the *German*. The new vessel will be propelled by twin-screws driven by two sets of triple-expansion engines, and while providing a very large carrying capacity for cargo the *Galeka* will have unusually complete accommodation for first, second, and third class passengers. She will be specially fitted with every convenience, including electric light and refrigerator and cold chambers for the conveyance of fruit. The *Galeka* is expected to sail for the Cape early in the new year.

Lord Downshire.—On November 2nd there was successfully launched from the South Yard of Messrs. Workman, Clark & Co., Limited, Belfast, a handsomely-modelled steel screw steamer, named the *Lord Downshire*, built to the order of the Irish Shipowners' Co., Limited, of which Messrs. Thomas Dixon & Sons, Belfast, are the managers. The dimensions of the vessel are:—Length between perpendiculars, 405 ft.; breadth, 48 ft. 6 in.; depth moulded, 32 ft. 3 in., with a deadweight carrying capacity of about 7,500 tons. She has been constructed under special survey to class 100 A1 in Lloyd's Register of Shipping, and is considerably in excess of the requirements of their society. There are two complete steel decks and a poop, long bridge-house amidships, affording protection to the engine and boiler casings; also a topgallant forecastle deck. The holds are divided into five watertight compartments, the lower portion being fitted with a permanent longitudinal bulkhead, to ensure safety against the cargo shifting. For the rapid handling of general cargoes, 10 powerful steam winches have been placed at the hatches, and where the masts are not available for working the derricks, crane posts have been introduced. The deck machinery is arranged for working the vessel with a minimum amount of trouble, and embraces the winches, steam steering gear, hand screw steering gear and steam windlass. The *Lord Downshire* is built on the cellular double-bottom principle, which provides for the carriage of water ballast required, when a vessel is in light condition; the peaks at extreme ends and a portion of No. 5 hold are also arranged as ballast tanks for trimming purposes. The saloon and accommodation for captain, officers, and engineers will be arranged in houses on top of bridge deck. Petty officers are berthed in the forecastle and the crew and firemen in the poop. The rig will be that of a two-masted fore and aft schooner. Machinery, consisting of triple-expansion engines and three steel boilers, has been constructed at Messrs. Workman & Clark's Engine Works, and will be placed on board without delay.

LAUNCH—German.

Aero. - On November 14th the Flensburg Shipbuilding Co. launched from their yard at Flensburg a small steel screw passenger and mail steamer of the following dimensions:—87 ft. 6 in. by 17 ft. 8 in. by 7 ft. 11 in. She is built to the order of the Dampskibselskabet Aero, who have been subsidised by the Danish Government to run this vessel between Aero and Fyn carrying mails and passengers to and fro. She will be fitted with compound engines having cylinders 14 in. and 26 in. by 16 in. On leaving the ways the vessel was christened Aero by Miss Else Bauer.

Smart Passage of Clyde Built Dredgers.—The dredgers *Fervid* and *Vtoroi* constructed by Wm. Simons & Co., Limited, of Renfrew. to the order of the Chinese Eastern Railway Co., arrived at Shanghai on 18th and 30th September respectively, after the remarkably quick passage, for dredgers, of 66 steaming days from Clyde.

TRIAL TRIPS.

Katso.—On October 20th the new steamship *Katso*, built by Messrs Edwards Brothers, North Shields, for the White Star Steam Fishing Co., Limited, Grimsby, had a successful trial trip on the Clyde. The engines, which were supplied by Messrs. Shanks, Anderson & Co., Glasgow, are of the triple-expansion type, of 480 H.P., boiler 180 lbs. working power to Lloyd's survey, worked with smoothness, and gave satisfaction to all on board.

Bloomfield.—On October 21st the screw steamer *Bloomfield*, which has been built to the order of Messrs. Hunting & Son, Newcastle, by the Tyne Iron Shipbuilding Co., and engined by the North-Eastern Engineering Co. (of which we gave particulars in our Launch columns, October issue, page 328), was taken on her trial trip. The vessel, built for the oil trade, has a carrying capacity of 6,000 tons of oil. The *Bloomfield*, with most of her tanks filled, was taken over the measured mile, attaining a speed of 11½ knots.

Norham Castle.—On October 24th the steam trawler *Norham Castle* was taken out from the Tyne upon her trial trip. This vessel is an addition to the fleet of the Castle Fishing Co., of which Mr. Richard Irvin, jun., is the manager. The hull is of wood, built by Mr. James Miller, St. Monance, Fifeshire. The engines, boiler, winch, &c., were supplied by Messrs. Baird & Barnsley, North Shields. During the run at sea the machinery gave every satisfaction to owner and builders.

Insizwa.—On October 24th this steamer, the 11th built for Messrs. John T. Rennie, Son & Co., of London, Aberdeen, and Natal, was taken to sea for her final trial, from the yard of Messrs. Hall, Russell & Co., builders, of Aberdeen. She is 342 ft. long, 41 ft. beam, 28 ft. deep, and is fitted out for 70 first and second class passengers, the first-class saloon and staterooms being placed amidships, and the second class aft. She has been designed for the direct Natal service, and the owners' long experience has provided a most comfortable and well-arranged system for all weathers. The ship is lighted throughout with electricity, and has cold chambers for provisions and fruit. Her machinery is of the triple-expansion type with cylinders 25½in., 42½in., and 69 in. diameter by 45 in. stroke, driven by powerful double-ended boilers. Many and various pumps are fitted with feed-heater, filter, freezing, and other machinery. The power developed on trial was fully 2,500 H.P., and drove the ship, which is fine lined, at about 14 knots speed. Mr. George Hall Rennie, senior partner of the owners' firm, accompanied by a party of friends, and Mr. Johnson, of Flannery, Baggallay & Johnson, of London and Liverpool, his consulting engineers, left Aberdeen for the south in the steamer after trial, and she will sail for Natal early next month.

Bali.—On October 25th the new steel screw steamer *Bali*, built for the Stoomvaart Maatschappij Nederland, and engined by Messrs. Bow, M'Lachlan & Co , Paisley (of which we gave particulars in our Launch columns, August issue, page 236), went down the firth on her trials. On leaving the dock the *Bali* proceeded to the measured mile and engaged in a series of exhaustive trials. These were in every respect satisfactory, and despite the unfavourable weather—the trial being conducted in a gale of wind—an average speed of 10·8 knots was maintained on the mean of four runs, the engines developing 1,650 I.H.P. The trials went off without a hitch, everything working smoothly, and the performance of machinery gave highest satisfaction to all concerned, so much so that, although in terms of the contract the trials were to extend over two days, the owners accepted the steamer on the merits of the first day's trials. At the trials the owners were represented by Messrs. Burgher and Meyers, the engineers by Mr. Bow, and the Bureau Veritas by Mr. Lucas. After trial and adjustment of compasses the *Bali* sailed for Amsterdam, where she will be engaged on the company's service between Java and Amsterdam.

Active.—On October 26th the trial trip of the steam trawler *Active* (of which we gave particulars in our October issue, page 331) took place, and proved highly satisfactory, a speed of 10½ knots being attained on the measured mile. The vessel is the second of two recently launched by the Irvine Shipbuilding and Engineering Co., Limited, for the Peterhead Trawling Co., Limited, and is equipped with all the latest appliances for trawl fishing.

Alma.—On October 26th the steel cargo steamer *Alma*, built by the Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, went on her trial trip. She has been built to the order of D. W. Ellerhusen, Esq., Bergen, and to Norwegian Veritas highest class. The vessel is of the following dimensions:—Length, extreme, 235 ft.; breadth, 32 ft.; depth, 15 ft. 8 in. She is 1,032 brutto register tons. The engines are of the triple-expansion type, about 580 I.H.P., and a speed of 10½ knots was attained. The ship has a steel deck, double bottom for ballast, peak tank abaft, and is specially built for the timber trade. She is well fitted out in every way, having Emerson-Walker's patent steam anchor windlass, Fisher's patent steam-steering gear, Bower's patent rapid closing apparatus for stop valve—worked from bridge as well as from engine room, Bower's patent protection box for propeller shaft, three steam winches, and large donkey boiler by Messrs. Clarke, Chapman & Co. The vessel and her machinery have been built under the superintendence of Mr. Fred. T. Hansen, Bergen. There were present on her trial trip the managing owner, Mr. D. W. Ellerhusen, and a large company of ladies and gentlemen. The trial was in every way a complete success.

Hirundo.—On October 26th the handsome new screw steamer *Hirundo*, built by Messrs. Wood. Skinner & Co., Limited, at Bill Quay-on-Tyne, and engined by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, to the order of Mr. Conrad Blumer Hofgaard, of Tonsberg, Norway (of which we gave full particulars in our Launch columns, November issue, page 367), left the Tyne for her official trial trip, which was in every way most successful, a mean speed of 10½ knots being obtained on the measured mile. There was a large number of ladies and gentlemen present, including Mr. Hofgaard, the owner of the vessel, Mr. Skinner and Mr. John Wood representing the shipbuilders, Mr. R. Philipson the engine builders, Mr. Goddard, Grimsby, and Captain Jacobsen. After the trial the vessel sailed for Pensacola, under the command of Captain Olsen.

Sardinero.—On October 30th the Campbeltown Shipbuilding Co.'s steamer *Sardinero* ran her speed trial at Wemyss Bay with highly satisfactory results. The *Sardinero* is a vessel of the single-deck type, of about 3,500 tons deadweight, and is intended for the same trade as the sister ships *Gorbea* and *Enero*, previously built by this firm for the same owners.

Clumberhall.—On October 31st the s.s. *Clumberhall*, built by Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, for the West Hartlepool Steam Navigation Co , Eimited, (of which we gave full particulars in our Launch columns, October issue, page 328), proceeded on her trial trip. After the compasses had been adjusted, the vessel went at full speed, and on completion of the trial it was ascertained a mean speed of 12 knots had been attained, which was considered very satisfactory, the engines working smoothly. The vessel afterwards proceeded to Cardiff to load a cargo for the East. The hull and engines have been constructed under the supervision of Mr. Robert Craig, marine superintendent, who represented the owners; Mr. A. S. Purdon, the shipbuilders; and Mr. Urquhart, the engine builders.

Hillglen.—On October 31st the new steamer *Hillglen*, a spar-deck steamer, built by the Northumberland Shipbuilding Co., Limited, of Howdon-on-Tyne, for Messrs. Hugh Evans & Co., of Liverpool (of which we gave particulars in our Launch columns, October issue, page 327), was taken to sea for her trial trip. The propelling machinery has been supplied by the Wallsend Slipway and Engineering Co., Limited, and consists of a set of triple-expansion engines, with large steel boilers working at 180 lb. pressure, the power developed during the trial trip being 2,000 I.H.P. On leaving the Tyne the *Hillglen* was loaded with about 2,000 tons ballast and bunkers, and, after adjusting compasses, proceeded on the measured mile, where a speed of 13 knots was attained.

Wearside.—On November 2nd the large side ballast tank steamer *Wearside*, built by Messrs. W. Grav & Co., Limited for Messrs. J. & E. Kish, Sunderland (of which we gave full particulars in our Launch columns, October issue, page 329), had her trial trip, which was a very successful one, the average speed being 10½ knots. The vessel proceeded to Cardiff, where she takes in a cargo of coal for the Cape.

Barendiz.—On November 6th this steamer, which has been built to the order of Messrs. Van Vliet & Co., of Ymuiden, Holland, by Messrs. Cochrane & Cooper, Limited, Selby (of which we gave particulars in our Launch columns, November issue, page 368), was taken to sea for trial, when an average speed of 10½ knots was obtained, everything working well and smoothly. A thoroughly exhaustive trial of the machinery was made, and everything worked satisfactorily.

Southwood.—On November 8th the new steel screw steamer *Southwood*, which has been built by Messrs. William Dobson & Co., Low Walker, to the order of Messrs. William Cory & Son, Limited, of London, proceeded to sea for her loaded trial trip, the result of which was in every way successful. The machinery, which has been built by the North-Eastern Marine Engineering Co., Limited, Wallsend, consists of a set of triple-expansion engines.

Hylas.—On November 11th the new steamer *Hylas*, which has been built by Messrs. Archibald McMillan & Son, Limited, Dumbarton, for Messrs. R. P. Houston & Co., Liverpool, had a very successful trial of her machinery. The *Hylas*, which is of dimensions 390 ft. by 48 ft. by 29 ft. to main deck, has been built to Lloyd's highest class. She has a complete shade deck from end to end, above which is placed accommodation for the captain, officers, and engineers, the crew being berthed forward. The vessel is fitted with every convenience for the safe and expeditious working of ship and cargo. The machinery has been constructed by Messrs. Rankin & Blackmore, the engines being of the triple-expansion type, and the boilers being fitted with Howden's forced-draught arrangement. The *Hy'as* is one of Messrs. R. P. Houston & Co.'s Government chartered steamers, and immediately after the trial trip she proceeded to Liverpool to load for South Africa. This is the third steamer delivered this year by Messrs. McMillan for Messrs. Houston, and they have still two others on hand for the same owners.

Harriet.—On November 15th the s.s. *Harriet* was taken to sea for her trial trip. She is a fine steel screw steamer, and has been built by Messrs. William Gray & Co., Limited, West Hartlepool, to the order of Mr. Martin Carl, of Copenhagen (of which we gave full particulars in our Launch columns, November issue, page 367). After adjustment of compasses by Mr. Berry, the vessel was headed for the Tyne, where she loads for a Mediterranean port. A very satisfactory run was made, the average speed being 10½ knots.

Denbighshire.—On November 16th the new screw steamer *Denbighshire*, being the fourth vessel built to the order of Messrs. Jenkins & Co., Limited, of London, for their Shire Line of steamers by the Sunderland Shipbuilding Co., Limited (of which we gave full particulars in our Launch columns, November issue, page 367) was taken to sea for her official trial trip, and was in every way most satisfactory, after which the vessel left for Middlesbrough, where she takes in the first portion of her cargo for Japan.

Spero.—On November 16th the *Spero*, built by Messrs. S. P. Austin & Son, Limited, at Sunderland, to the order of Messrs. R. S. Gardiner & Joseph Reay, of the Pelton Steamship Co., Limited, Newcastle-on-Tyne (of which we gave full particulars in our Launch columns, November issue, page 368), ran a loaded trial trip off the Tyne. Notwithstanding the fog prevailing at the time of the trial, the vessel steamed at an average of 9½ knots, the engines working smoothly and satisfactorily. The machinery was supplied by Messrs. George Clark, Limited. The company on board included Captain Harland, representing the owners; Mr. Robson, representing the builders; and Mr. Esdon, representing the engine builders.

Ravenscraig.—On November 18th the steamer *Ravenscraig* had a successful trial trip on the Tay. The vessel has been built by the Dundee Shipbuilders Co. for the Kirkcaldy Steamship Co., and is intended for general trade between Kirkcaldy and Hull. Over the measured mile the steamer attained a speed of about 11 knots. The gentlemen representing the company expressed themselves as highly pleased with the vessel.

Etruria.—On November 23rd the handsomely modelled steel screw steamer *Etruria* left the yard of her builders, Messrs. Craig, Taylor, & Co., Thornaby-on-Tees (of which we gave particulars in our Launch columns, November issue, page 369), for her trial trip in Tees Bay, which proved highly satisfactory. During the whole of the trip the engines worked without the slightest hitch, a speed of 12½ knots being maintained against a strong wind and tide. The owners, Messrs. A. C. de Freitas & Co., Hamburg, were represented by Captain G. Cantieny, who expressed himself as being highly pleased with both the ship and engines. The vessel afterwards left for Cardiff, under the command of Captain Lorenz.

Syrian.—Lately, the steel screw tank steamer *Fyrian*, built by the Grangemouth Dockyard Co., to the order of Messrs. Jacobs & Barringer, of London, acting on behalf of clients in the East (of which we gave particulars in our Launch columns, October issue, page 330) went down the Firth of Forth on her official steam trial with coal fuel. Previous to the steaming trials the oil compartments were filled up with water by the powerful installation of pumps designed for dealing with oil cargo or water ballast, the whole of the compartments being run up in five hours. Thereafter two runs were made between Inchkeith and Oxcar lights, when the mean speed was found to be nearly 10¾ knots, or fully three-quarters of a knot in excess of the contract speed. The engines, supplied by Messrs. Hutson & Son, Limited, Kelvinhaugh, Glasgow, are triple-expansion, with cylinders 19 in., 31 in., and 51 in. respectively, and 36 in. stroke, and are supplied with steam at 180 lb. pressure by two large single-ended boilers. During the trial these worked most satisfactorily. For the working of the winches, fans, and oil pumps a large multitubular horizontal type boiler for 120 lb. pressure has been provided. The owners, who were represented at the trial by Mr. Barringer, London, expressed themselves as entirely satisfied with both hull and machinery. On November 2nd, the oil fuel trial of the tank steamer *Syrian*, took place in the Firth of Forth. The result obtained was still more satisfactory. The oil used was that technically known as astatki. On running the measured distance the speed was 11½ knots, or nearly a knot more than was the case with the Scotch coal. The number of revolutions was seven to eight more per minute, and the horse-power 200 more than at the coal trial, whilst the steam pressure of 180 lb. was obtained with ease, notwithstanding that all the auxiliary machinery was running the whole time. The consumption of oil at the trial was found to be 25 per cent. less per horse-power than the consumption of the coal. A number of experts, besides representatives of the owners, were present, and expressed themselves as highly satisfied with the successful results obtained, and predicted a bright future for this fuel for marine purposes. We understand it is the intention in the case of the sister ship now fitting out by the same builders to ship sufficient oil fuel to take her to her destination in the East. When on their regular services both vessels will use oil fuel exclusively.

Ino.—Lately the steamer *Ino*, built by the Campbeltown Shipbuilding Co. to the order of the Bristol Steam Navigation Co., Limited, ran her loaded speed trial at Stokes Bay, when an average speed of 10 knots was obtained. The *Ino* is intended to carry general cargo between the Continent and Bristol and Gloucester, and is the third vessel which the Campbeltown Shipbuilding Co. have built for the same owners for this trade.

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from October 13th to November 7th, 1899.

20529	J. R. Wigham.	Marine fog signalling.
20533	R. McGregor.	Pumps.
20539	H. Haddon.	Shaft protectors.
20542	D. Croll.	Steam generators.
20560	J. Shepherd & E. N. Banks.	Duplex pumps.
20579	M. Christoph & J. Walch.	Life-belts.
20586	E. Latham.	Regulating boiler feed water.
20589	A. E. Mann & H. F. Young.	Crank.
20591	A. J. Wilkinson.	Apparatus for saving life at sea.
20592	J. M. Kline & S. A. Wetzel.	Hydraulic rams.
20598	J. A. Ageron.	Internal combustion engines.
20607	J. P. Gorton.	Translating cable signals.
20638	J. E. Slack.	Steam traps.
20663	Smith & Coventry, Limited, W. D. F. Smith, and T. Coventry.	Chucks.
20677	R. J. Houghton.	Piston ring.
20680	E. Grimault.	Valve.
20689	F. W. Smith.	Extinguishing electric lights.
20694	J. E. Liardet.	Steering gear.
20718	C. A. Schopper & A. W. H. Roder.	Rotary expansion engine.
20722	C. J. Simeon.	Operating slide valves of engines.
20740	B. Jumeaux.	Screw propellers for steamers.
20771	R. J. Hutchinson	Variable speed gear.
20776	J. E. Carroll.	Water heating for steam boilers

20779 H. See. Covers for the cross hatches of vessels.
20830 J. Maxton. Revolving ventilator cowls.
20839 R. C. Thomson. (F. R. Patey, Chili.) Ships or vessels.
20858 E. Edwards. (F. O. Neuhauser, Austria.) Screw propellers.
20866 W. P. Thompson, (P. A. Henningsen, Germany.) Steam boilers.
20867 C. H. Homan. Submarine boats.
20879 J. Weir. Steam engines of vessels, &c.
20905 G. Hirt & G. Horn. Internal combustion engines.
20927 R. Haddan. (J. E. Whiting, India.) Sluice gates.
20947 B. S. Miles. Cleaning ships' bottoms.
20961 J. Bibby, jun. Internal combustion engines.
20969 A. Livie. Rowlocks for boats.
20974 T. Christie. Couches for use on board ship.
20982 J. H. Bell. Moulding ships' bulwarks.
20992 J. F. & J. W. Cooper. Packing rings.
21016 F. Hacking. Protecting ships' propellers.
21025 E. C. Blackstone and F. & E. Carter. Internal combustion engines.
21026 A. Angstrom. Passenger steamers and ships.
21033 N. N. Haigh. Steam traps.
21036 C. C. A. E. Wiese & C. F. M. Groschner. Life-buoys.
21038 R. H. Mantel. Lifting valves for engines.
21056 W. Fairweather. (The Babcock & Wilcox Company, United States.) Forced draught system.
21064 A. Berry & E. G. Nockles. Indicators for ships' logs.
21065 W. M. Webster. Covers of ships' hatches.
21102 P. Cornish. Steam generators.
21116 E. Wendt. Double-acting pump cylinders.
21146 J. W. Mackenzie. (R. Kron, Germany.) Valve gearing for steam engines.
21160 A. J. Boult. (C. Krausse, Germany.) Refrigerating apparatus.
21169 J. Steiner. Life-belt.
21215 W. A. Koneman. Rotary engines.
21225 H. J. Haddan. (J. Lehman, United States.) Steering apparatus for boats.
21236 J. Reagan. Chopping grates for boilers.
21254 G. A. Burwell. Lubricators.
21257 M. Hajos, F. Konczol, and I. Szecsenyi. Swimming belt.
21262 E. B. Weston & W. W. Jackson. Automatic regulating weirs.
21263 J. Vavasseur. Armour plates.
21269 F. Altenstein. Closing the tube holes in water-tube boilers.
21323 A. Aston. Adjustable roller bearing.
21326 A. Wordsworth. Hydraulic valves.
21394 W. Vance. Propellers.
21409 S. Kapralik. Valves.
21433 G. W. Tarver. Sailing models of ships.
21478 R. W. Jacobs. Steam generators.
21492 C. R. Emrich. Propellers for vessels.
21524 H. Pearce. Ships' compasses.
21547 J. Barton. Marine life-preserver.
21550 J. Missong. Steam engines.
21616 J. M. Campbell & P. T. Dixon. Steam boiler furnaces.
21642 C. Heinle. Means for starting oil engines.
21674 E. A. Jones & C. J. Holroyde. Engine governor.
21689 G. Fisher. Lubricators.
21691 G. A. Longsdail. Buoyant body attachments.
21695 H. C. Stephens. Conveying ashes out of ships' stokeholds.
21704 B. W. Rice & F. J. McFarlin. Boilers.
21705 T. Lishman. Vertical water-tube boilers.
21706 T. Lishman. Generating steam.
21746 T. P. Greger. Manhole frames and covers.
21771 Simpson, Strickland & Co., Limited, and W. Cross. Steam engines.
21811 I. M. Escala. Propelling gear for ships.
21813 K. A. Posse. Device for steering ships.
21826 A. Taylor. Pneumatic tools.
21828 J. Oakley. Life-saving rafts.
21845 T. Patterson. Rudders.
21851 J. C. Heinsen & J. F. W. Nuppnau. Fishing nets.
21866 F. Drake. New steam engine air pumps.
21867 F. Drake. Cylindrical marine boilers.
21878 C. C. M. de Luna. Rudders for ships.
21897 R. H. Longworth. Induced draught apparatus.
21901 E. Edwards. (J. Tschumpe, Bohemia.) Driving gear for machinery.
21925. J Grau & K. Bohn. Double piston engine.
21940 T. Sugden. Heaters for steam generators.
21957 J. R. Starbuck. Engines.
21959 H. H. Lippmann. Measuring depth of water.
21961 J. Edwards. Dredging apparatus.
21964 T. Smith. Fold-up ships' berths.
21973 J. Albardo. Apparatus for stopping ship.
21982 F. R. Putz & J. R. Yates. Steam traps.
21983 E. Brooks. Keels for sailing vessels, &c.
21985 J. Price. Winding drum for winches, &c.
21997 J. S. Gibbons. Marine engine controllers.
22025 J. Cowan and the Stirling Boiler Co., Limited. Water-tube boilers.
22029 H. A. C. M. Holz. Speed indicator for ships' engines.
22031 D. Baker. Cranks.
22035 S. W. Allen. Boilers.

BOARD OF TRADE EXAMINATIONS

NOTE.—1C denotes First Class; 2C Second Class.

October 28th, 1899.

Bell, George A.	1C	N.Shields
Black, Geo. L..	1C	Aberdeen
Breden, F. C...	1C	London
Coates, Edward	1C	N.Shields
Dawes, Albert..	2C	Hull
Dearden, Robt..	2C	Liverpool
Duncan, John P.	1C	Aberdeen
Goode, Wm. C..	2C	London
Jackson, T. S...	1C	Hull
Jones, John H..	2C	Liverpool
Kennedy, Rbt. L.	2C	N.Shields
Knight, E. E...	1C	Liverpool
Lidgerton, R. ..	1C	S'nd'land
M'Coy, J. R. W. D	1C	London
Moore, Alfred T.	2C	Londdrry
Robertson, G. F.	1C	London
Rutherfoord, W.	2C	Aberdeen
Stark, Jas. Y...	1C	London
Stuart, Lewis..	2C	,,
Suggitt, Wm. A.	1C	,,
Taylor, Fredk. J.	1C	S'nd'land
Thompson, H. T.	2C	Londdrry
Tilston, Wm. ..	2C	London
Verhoef, Wm. J.	2C	,,
Will, Thos.	2C	Aberdeen
Wilson, P. H...	2C	London

November 4th.

Adey, Joseph L.	2C	N.Shields
Allan, J. S. B..	1C	Cardiff
Anderson, Jas..	2C	Glasgow
Barber, Geo. B.	2C	N.Shields
Bennett, Wm...	1C	Glasgow
Bowen, W. H...	2C	Cardiff
Brown, S. C. ..	2C	,,
Campbell, Peter	2C	Liverpool
Campbell, Peter	2C	Glasgow
Clyne, Wm......	2C	London
Cook, Frank A.	2C	Cardiff
Cowley, George	2C	Glasgow
Dobson, T. R...	1C	N.Shields
Franks, C. E. F.	2C	Cardiff
Fraser, John ..	2C	Glasgow
Galloway, F. W.	2C	Liverpool
Gilligan, Robt..	1C	,,
Gronberg, Johan	2C	London
Hudson, Henry	1C	,,
Johnston, T. L..	1C	Glasgow
Leask, James ..	1C	N.Shields
Leggett, W. B..	1C	Glasgow
Linden, Albert	1C	Cardiff
Lowden, H. W.	2C	Liverpool
Miller, Alexr. ..	2C	London
M'Master, H. E.	1C	Glasgow
Nairn, Matthew	1C	,,
Nixon, John E.	1C	London
Ramsay, George	1C	Glasgow
Roberts, Rhys..	2C	Cardiff
Rule, John	1C	Cardiff
Stothert, R. C..	2C	,,
Tait, Robert ..	2C	Glasgow
Vine, Geo. A. ..	1C	Cardiff
Wright, Alexr..	1C	Glasgow

November 11th.

Brooke, Thos. C.	2C	London
Cunningham, J.	1C	Liverpool
Hoey, John	1C	,,
Looney, E. B...	1C	N.Shields
Menlove, Geo. A.	2C	Liverpool
Pinkney, T. W.	2C	N.Shields
Roy, Andrew T.	1C	London
Scott, John A...	2C	,,
Smith, Geo. W.	1C	,,
Tait, Wm.	2C	N.Shields
Tweedy, Alexr...	1C	,,
Woodall, P. S..	2C	London

November 18th.

Anderson, P. A.	1C	Leith
Brands, John ..	2C	London
Burnyeat, J. S.	2C	Liverpool
Cartwright, E. L.	2C	Hull
Collier, Wm. ..	2C	,,
Dorward, Wm.	1C	London
Dring, H. L. F.	2C	Hull
Drysdale, Peter	1C	Greenock
Goat, Wm. J. A.	1C	Liverpool
Hadden, Wm. ..	2C	Leith
Hay, George G.	1C	Greenock
Kingcombe, G. E.	1C	London
Landstein, W...	1C	Liverpool
Linsley, Thomas	2C	Hull
Macauley, Jas...	2C	Dublin
MacEwen, A. G.	2C	Greenock
Malpas, Emus S.	1C	London
McCulloch, John	2C	Liverpool
McIntyre, Arch.	1C	Greenock
Milliken, Thos.	2C	Dublin
Murray, J. P. ..	2C	Greenock
Newton, H. E.	1C	London
Noall, Albert ..	2C	,,
Pullar, Charles	2C	N.Shields
Raby, William	2C	Dublin
Reay, Frank C.	2C	N.Shields
Rodger, Robt. G.	1C	Leith
Russell, John ..	2C	Dublin
Sloan, Thomas	2C	Leith
Smailes, Jas. V.	1C	Hull
Smiley, J. G. F.	2C	Dublin
Smiley, Robert	2C	,,
Spratly, Chas. S.	2C	Liverpool
Stirrat, Alex. Y.	1C	Greenock
Thompson, Alex.	2C	Liverpool
Thompson, D. G.	2C	London
Tyson, John H.	1C	N.Shields
Wase, Robert ..	1C	,,
Wright, Morris'n	1C	Greenock

The Marine Engineer.

LONDON, JANUARY 1, 1900.

AGAIN we have to claim recognition for the services of the engineering branch of the Royal Navy as compared with the readiness of public praise to the executive branch. We have all heard of splendid services rendered by the Navy in the public service in South African waters in the designing and making of the special carriages for the 4·7-in. naval guns that have proved such a terror to the Boers and of such magnificent service to the defence of Ladysmith and in other portions of the campaign; but the public has never heard any mention of the chief and assistant engineers who perfected the designs and who carried out the work. Nor has the following fact, which has come to our ears from a private and authoritative source, ever to our knowledge been made public—viz., that amongst the naval party selected from Durban to accompany the naval guns to Ladysmith were engineers selected from the engine-room staff to mount those guns on their carriages upon their arrival at Ladysmith. We all heard of the marvellous celerity and workmanlike manner in which those guns were mounted and brought so promptly into action; but we have not publicly heard of the presence of selected naval engineers in the naval contingent told off for that duty, and that there are members of our profession actively engaged at the front and responsible for the perfect carrying out of engineering work in the face of the enemy. It is not for these men to blazon forth their patriotic devotion to duty, and if it lay with them the world might never hear of it; but it shall not be our fault if public attention is not drawn to another example of the essential value and importance of the services of marine engineers, whether in peace or war. Every day the development of guns and gunnery, and of the intricate mechanical appliances necessary for the working of such guns, renders greater the importance of the services of the naval engineer and the necessity of according to him a due recognition of his importance.

IT is a strange fact that seagoing engineers, whether of the commercial marine or of the Navy, are so reticent of their experiences and of their troubles frequently overcome with magnificent persistence and ingenuity at sea. If it depended only upon the engineers themselves to give the benefit to their fellow-workers, and indirectly to engineering designers, manufacturers, and inventors of their experience as to failures and breakdowns, little would ever be heard of such matters. And yet what is more valuable to all those connected with the production of machinery, or to the shipowners or Admiralty as the users of such machinery, than to have full particulars of breakdowns or failures at sea. Such particulars, to be in a form most useful to all interested in seagoing machinery, need not necessarily be invidious either to individual manufacturers, to ships, or to those in charge, as facts only (without identification), methods of repair, or consequences following unexpected failure in apparently trifling or auxiliary machinery would carry lessons of enormous importance to all, without reference to specific vessels, if properly substantiated as between recipient and communicant. Such a journal as ours is essentially the organ for such communications, and we regret that our repeated invitations on the matter to seagoing engineers has met with such little response. We published some months back a detailed account of a disaster to the machinery of a trading steamer, and some slight account of the repair effected; but we are sorry to say we were indebted to the second executive officer for the account instead of to one of the engineers. It is obvious that information from the latter quarter would probably have much exceeded the interest of the account from the former quarter, as it could have dealt much better and in more detail with the engineering difficulties and the devices eventually adopted for repair. It is curious, too, how little is ever heard of failures of machinery on board our warships after the machinery has left the contractors' hands. It is probably assumed by the Admiralty that it is not their business to instruct marine engine-constructors at large, and the dearth of information in no way implies to our mind that there are not many interesting examples of failure from which much might be learnt. We believe it is not the practice of the Admiralty to go out of their way to collect or distribute information to the many makers of special machinery, of which there is so much now on every war-vessel, of the troubles or failures that may have been found in their specialities, once they have been passed and taken over by the Navy. Probably the result is merely a cessation of orders for the future. But would it not much better advance engineering improvement if the makers' attention were specifically directed by precise information to any weak spots in design or construction that might be found in seagoing practice. If this cannot be obtained officially from the Admiralty or from shipowners, much might be done for the benefit of the marine engineering profession by the practice of seagoing naval or commercial marine engineers giving particulars of such cases as might have come under their own observation. Nothing teaches like failure. Our columns are always eagerly open to such information, however crude and bare may be its form; and we trust our sea-going readers will be found public-spirited enough to take the small amount of trouble necessary to record such experiences with us.

THE Cambridge University journal is voicing some of the troubles of the graduates of that University who go there to learn the scientific bases of their professions, particularly that of engineering. It was held that the requirements of engineering employers, that such young men had still to learn the practical rudiments of their profession, and that a further three or four years' pupilage in works was generally enforced before they were considered worth their bread and butter, was quite an unreasonable demand. We fear this expression of opinion is made by those who, however cultured they may be in the scientific part of the engineering, have little grasp of the familiar acquaintance with practice that is necessary to make an engineer worth his salt. Engineering is as much a training of eye and hand as it is a matter of abstruse calculation. Young men in their preliminary posts as engineers must be competent to oversee and direct the actual workmanship of artisans, if not to lend a hand in the actual performance, and the necessary self-confidence for such a position and the power to obtain the obedience of the men under them always must result from a practical personal experience amongst the men and in the particular class of work they are carrying out. This can only be attained by some considerable apprenticeship or pupilage to the practical work. It is as if a doctor was considered qualified to practise after having passed scholastic examinations without having passed through the practical ordeal of the hospitals. If doctors can simultaneously qualify themselves whilst walking the hospitals for their necessary scholastic examinations, why cannot young engineers equally train themselves in the scientific part of their profession whilst passing through their practical course in workshops or on works being carried out? There is no doubt that a great majority do this now, and if a young man must commence his acquirement of engineering by a University training, he must be content, we are afraid, to recommence his practical education after he has completed his University career. He may make the better engineer in the long run, though many of our foremost engineers of the last generation were what would now be considered almost illiterate at the commencement of their career. Sometimes a too erudite education for an engineer but makes him a pedant in his profession, splitting straws upon slight variations of theoretical calculations; whilst the man with practical experience and intuition would know that the allowance for safety—required for possibly faulty material or for almost uncalculable stresses, which, however, he knows to be there, will more than cover any discrepancies between various hair-splitting theories, which he can thus entirely ignore and is often better without. A University career prior to introduction to the profession of engineering can only be considered a luxury, carrying with it serious delay in the completion of the necessary practical curriculum.

TRIPLE-SCREW propulsion of which one screw is located in the fore-part of the hull is now being adopted in many directions with great advantage in some respects to the vessels so fitted. Curiously enough, however, the subject appears to have been thoroughly tested, experimented, and reported upon as far back as 1879 and 1880. In these years during the building of the *Livadia* a series of exhaustive trials, under the instructions of the late Sir William Pearce and the late Mr. A. D. Bryce Douglas, were carried out at Fairfield upon the different behaviour for propulsion of one screw, two screws, and three screws, and in different positions fore and aft. Afterwards in 1887 a series of steam trials on the Black Sea were made by Russian officers on the same subject and were analysed and compared with the original model trials by Dr. Kirk. The reports are now, we believe, to be made public, and will be very interesting reading. Dr. Kirk, it is believed, found that the propulsive efficiency up to 15 knots was the same whether the total power was divided between two or three screws, but that for higher speeds the distribution over three screws would be probably advantageous and that the steering was improved by employing the third screw, and that at very low cruising speeds the third engine was a desirable feature.

A CONTINUOUS MEAN-PRESSURE INDICATOR FOR STEAM ENGINES.[*]

By PROFESSOR WILLIAM RIPPER,
Member, of Sheffield.

THE instrument described in the present paper was devised in the first instance for the purpose of measuring the mean effective pressure on the piston of engines running at high rotational speeds. For this purpose an arrangement was adopted to separate the driving or impulse pressures from the resistance or back pressures, and to divert these two separate effects into two separate pressure-gauges, so that one gauge might give a continuous reading of the mean effect of the driving pressures only, and the other the mean effect of the back pressures only, the difference between the two gauge readings being the net mean effect. It was afterwards found

---

[*] Read at a meeting of the Institution of Mechanical Engineers on Friday evening, December 8th, 1899.

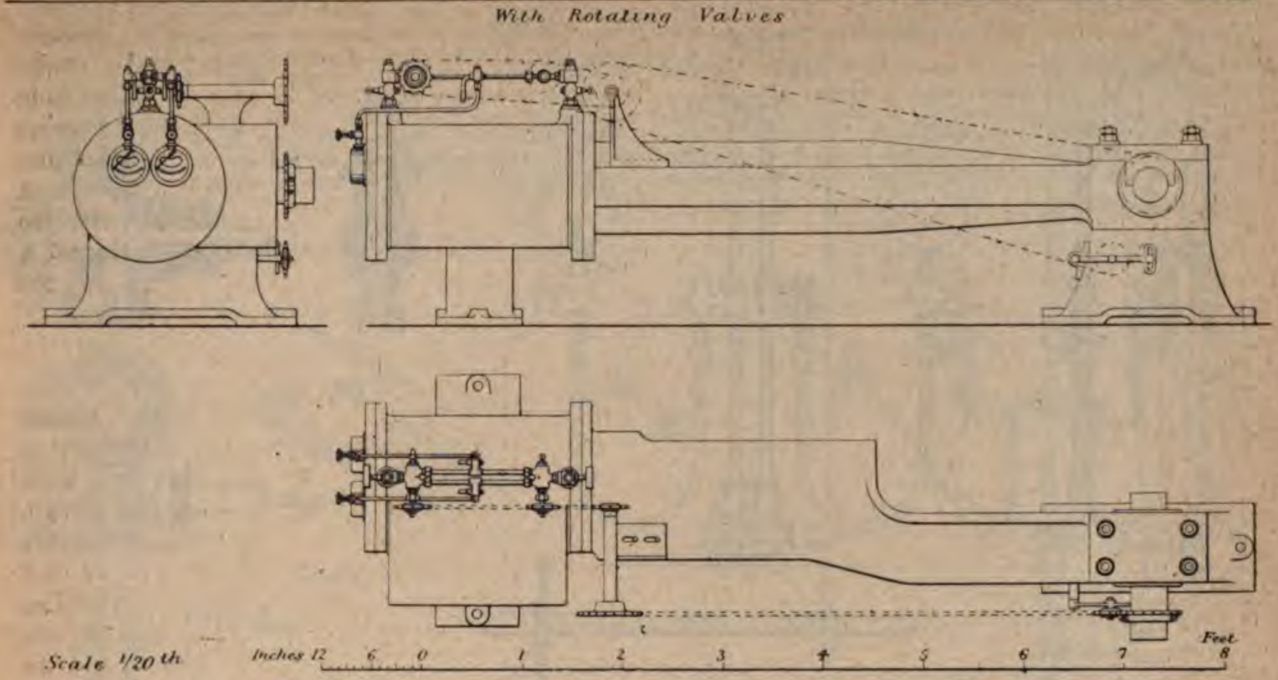


FIG. A.

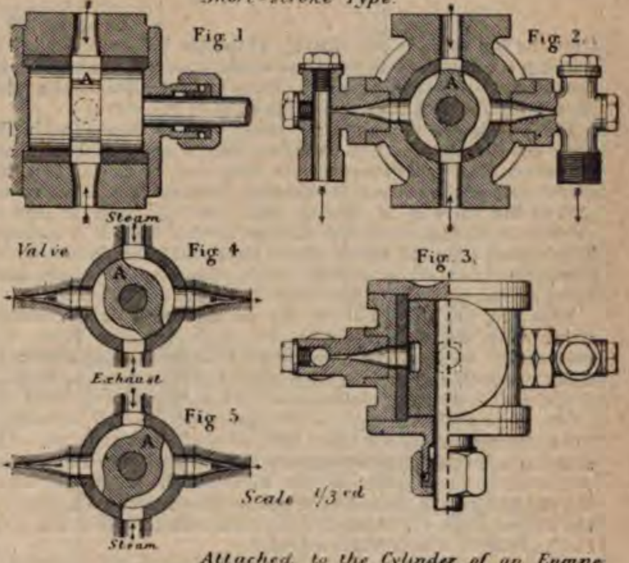
possible to use the same instrument for engines running at any speed, high or low.

Description of the Instrument; Short-stroke Type.—In the proceedings of this institution (1897, page 347) in connection with the discussion on Mr. Morcom's paper on High-Speed Engines, a description of the earliest type of this instrument was given, but since that date it has been somewhat modified, valves with either an oscillating or rotating motion (see Fig. A) having been substituted for a reciprocating motion of the spindle of the valve.

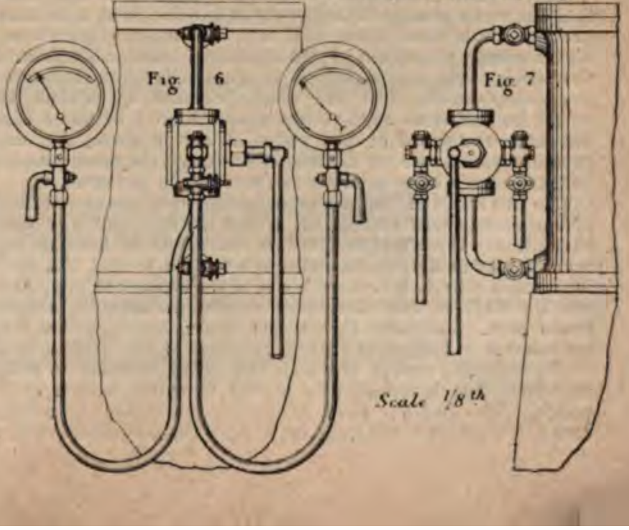
Figs. 1, 2, and 3 illustrate to one-third full size the simplest type of the instrument. Figs. 6 and 7 show the same instrument attached to the cylinder of an engine. Fig. 2 shows the valve A in mid-position. The piston of the engine is then supposed to be at the top or bottom of its stroke. Fig. 4 shows the position of the valve, when the engine piston is at or about mid-position, and passing from the top to the bottom of the stroke, the steam from the top side of the piston passing into the driving-pressure gauge, and the steam from the bottom side of the piston passing to the exhaust gauge. Fig. 5 shows the valve reversed, when the piston is travelling in the opposite direction. The driving steam again passes to the driving-pressure gauge, and the exhaust steam to the exhaust-pressure gauge, as before. The valve has no lap on either the steam or exhaust edges, and the respective ports are open to both gauges for the full length of the stroke. The valve is moving at its maximum speed at the points of opening and closing—that is, at the beginning and end of the engine stroke.

Long-stroke Type.—In order to prevent loss of pressure through excessive length of the pipes which attach the instrument to the cylinder in long-stroke engines, separate valve-boxes C and D, Figs 8 and 9, are substituted for the single instrument, Figs. 1, 2, and 3. These valve-boxes are placed as near as possible to each end of the cylinder, so that they may take the steam at once, without loss of pressure due to passing through pipes. The valve-boxes are connected by pipes E and F, as shown, and the valves are so constructed as to turn the driving steam into one gauge G, and the back-pressure into the other gauge H. The arrangement of the valves A and B is shown in the sectional view, Fig. 13. The engine piston is supposed to be at the top of the stroke. The valves A and B are moving in the direction of the arrows. The top valve is opening communication between the top of the piston and the driving-pressure gauge, through the centre of the valve, and down the pipe E to the gauge G, Fig. 9; whilst at the same moment the lower valve B has closed the steam communication between the lower end of the cylinder and the driving-pressure gauge. At the same

Short-stroke Type.



Attached to the Cylinder of an Engine.



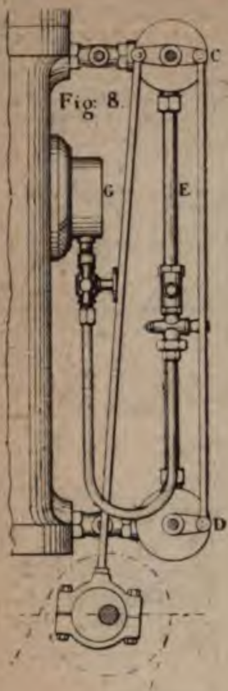


Fig: 8.

Attachment to Vertical Cylinder Long-stroke Type

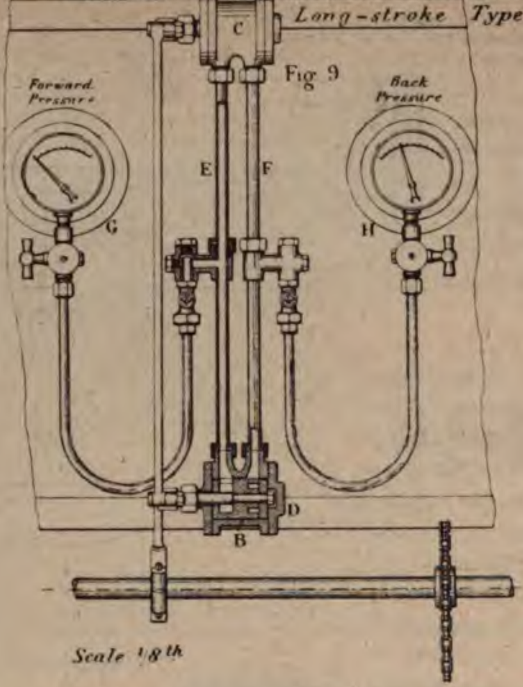


Fig 9

Scale 1/8th

Rotating Valve for High Speeds

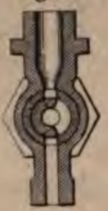


Fig: 10.

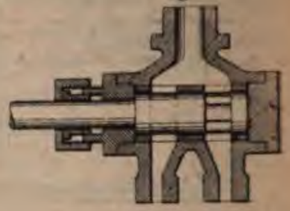


Fig. 11

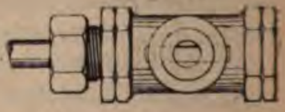


Fig. 12

Scale 1/3rd

time the top valve is just closing, whilst the bottom valve is just opening communication with the exhaust side of the piston and the exhaust-pressure gauge H. There is a partition in the valve separating the steam and exhaust sides of the valve.

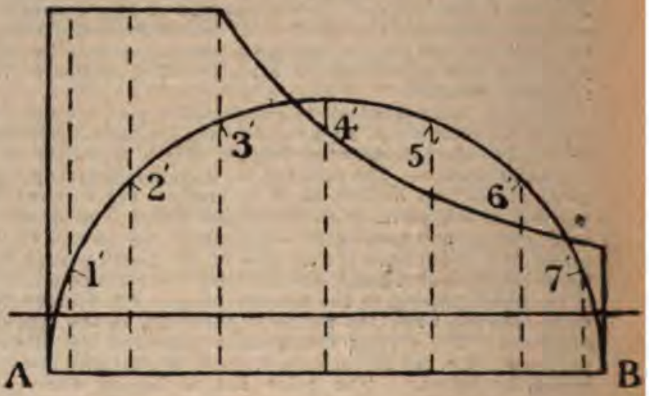
Fig. 14 shows an isometric view of the valves with the ports cut therein, and Fig. 15 shows that, when the faces of both valves are moving together in the direction of the arrows, the steam port of the valve A is opening to steam whilst the steam port of the valve B is closing; also that the exhaust port of valve A is closing while the exhaust port of valve B is opening. The valves oscillate about their axes, and are driven by an eccentric fixed on a counter shaft, the counter shaft itself being driven by a chain gear from the main engine shaft.

Figs. 10, 11, and 12 show the arrangement of the instrument with a rotating valve for high speeds. With this instrument no eccentric is required, the valve being driven by a chain wheel. The valve is hollow and has two openings or ports, which are on opposite sides and at opposite ends of the valve. The ports are respectively open during a half revolution to steam and during the other half revolution to exhaust. The steam is admitted to the gauge by entering the port at one end of the valve, passing through the centre of the valve, and entering the gauge pipe through the port at the other side and end of the valve. Figs. 17, 18, and 19 show the attachment of the long-stroke type to a horizontal cylinder.

Time-Pressure Diagrams.—The first point to be observed is that the mean pressure obtained by this instrument is the mean pressure on a time base, and not the mean pressure on a distance base, as is given by the ordinary indicator diagram. If the piston of an engine moved at a uniform speed throughout the piston stroke, then the mean pressure on a time base would be the same as the mean pressure on a distance base; but since the speed of the piston is not uniform, the mean pressure per stroke on a distance base, and the mean pressure per stroke on a time base, are not necessarily the same.

The two kinds of diagrams are illustrated by the two methods of indicating shown in Fig. 16, where the indicator A is one of the ordinary type, whose drum is connected by a string to a moving part of the engine giving it a motion to and fro, which is an exact copy to a reduced scale of the motion of the piston; and the diagram thus obtained is a pressure diagram on a distance base. Indicator B, on the other hand, differs from indicator A in having its drum connected to the engine by an endless cord, by means of which the drum is made to rotate uniformly and independently of the irregular motion of the piston. The diagram thus drawn on the uniformly rotating drum is a pressure diagram on a time base, because it gives

(*a*) Distance-Pressure Diagram.



(*b*) Time-Pressure Diagram.

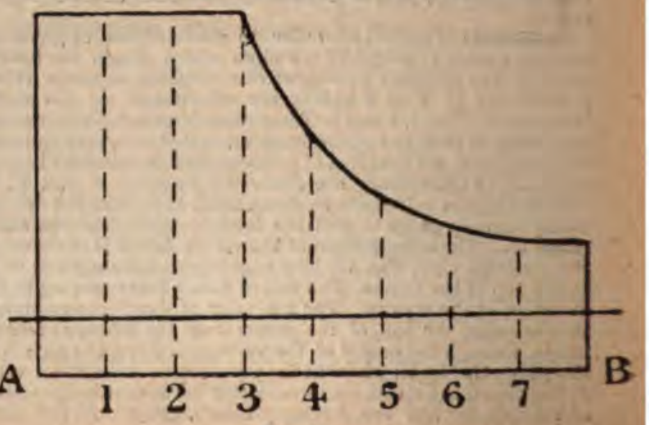


Fig. 25.

the pressure during successive intervals of time, without regard to the space moved through by the piston in those intervals. But since work is measured by pressure X distance only, it is important, if the mean time-pressure reading given by the gauges is to be of practical value, that it should be very nearly the same as the mean distance-pressure, or otherwise that there should be a definite and known ratio between them, which may be used for converting the one into the other. In practice the actual difference is small, as will be shown below, but whatever the difference may be, provided the ratio between the two kinds of mean pressure is definitely known, it is easy to convert the one into the other directly by the use of a factor expressing the known ratio.

A difficulty here suggests itself that the conditions may be very variable in the same engine, and that different points of cut-off and compression would require different factors; but it is possible in practice to use an average factor, which may be applied through all ranges of power, in the same engine, to convert the mean time-pressure into the mean distance-pressure within very narrow limits of error. This may also be done

Valve for Long-stroke Type.

Fig 13.

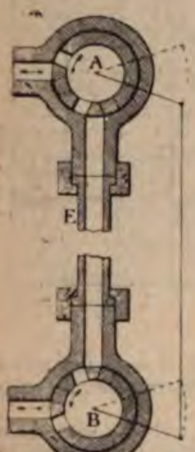


Fig 14

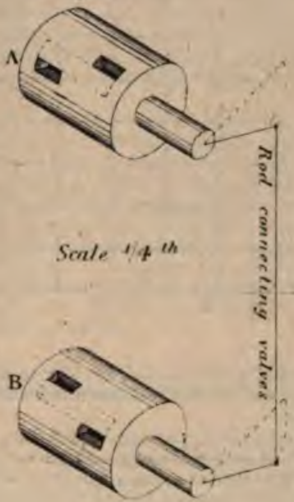
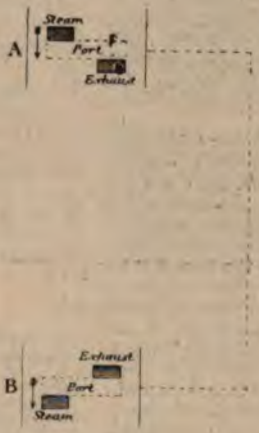


Fig 15



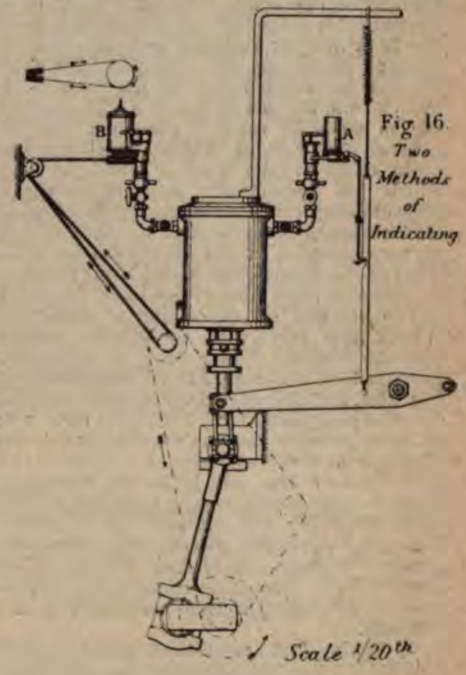


Fig 16. Two Methods of Indicating

Attachment to Horizontal Cylinder Long-stroke Type.

Fig 17.

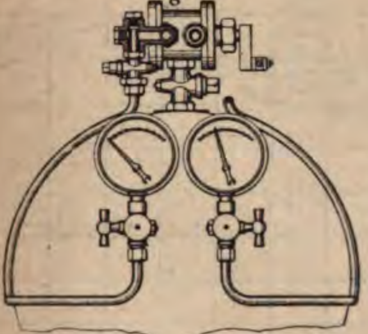


Fig 18.

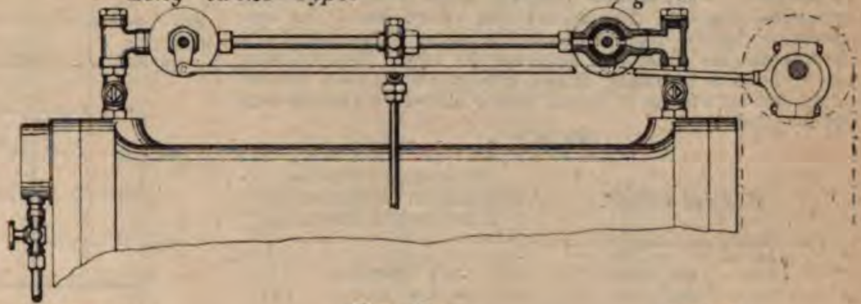
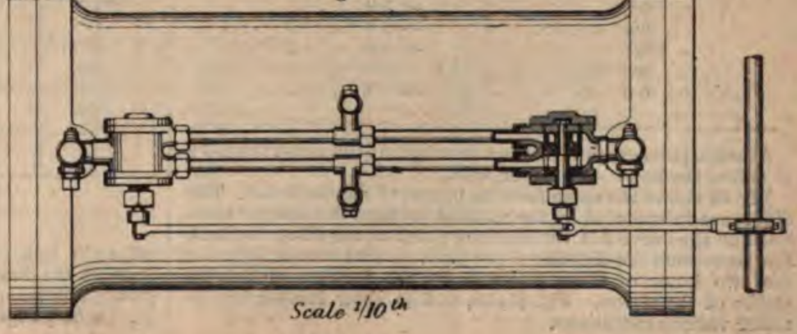


Fig 19



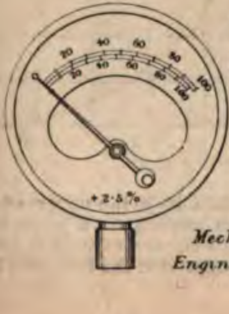


Fig 20 Pressure Gauge Scale 1/5 th

Mechanical Engineers 1899

without any calculation by an adjustment of the scale of the pressure gauge, as shown in Fig. 20.

By the arrangement shown in Fig. 16, the diagram drawn on the drum of indicator B is shown in Fig. 22, and includes the forward pressure and the back pressure in one continuous line.

If an ordinary indicator be attached to the mean pressure instrument in the manner shown in Fig. 21, then it is possible by coupling the indicator to the driving-pressure nozzle to obtain, on one card, the forward or driving-pressure lines taken together on one continuous roll, Fig. 23, or, again, by coupling the indicator to the back-pressure nozzle it is possible to obtain the backward or resisting pressure lines taken together on another continuous roll, Fig. 24. If a dotted line be drawn through the mean height of the variable pressure line, as in Figs. 23 and 24, this dotted line will represent the mean effect of the series of variable pressures, Fig. 23 for the driving strokes and Fig. 24 for the back pressure strokes. This mean effect is the reading given by the pressure gauges, which are respectively attached to the driving and back pressure sides of the instrument. The movement of the pointers of the gauges is reduced to a minimum by throttling. The higher the speed of the engine the more steady is the movement of the finger, other things being equal.

Relation between Time-Pressure and Distance-Pressure Diagrams.—The method of converting a distance-pressure diagram *a*, such as is taken with an ordinary indicator, into a time-pressure diagram *b* may here be explained. A semicircle is described on the base AB of the distance-pressure diagram, Fig. 25 *a*, and the semi-circumference is divided into any number of equal parts, 1 ft., 2 ft., 3 ft., etc. Also the base AB for the time-pressure diagram *b* is divided into the same number of equal parts. Draw at positions 1, 2, 3, etc., on *b* perpendiculars from the base line AB, in height equal to the height of the distance-pressure diagram *a* at positions 1 ft., 2 ft., 3 ft., etc., of the crank pin, and join the tops of these lines by a curve. Then this curve will give the forward pressure line of the time-pressure diagram. A similar method is used for the back-pressure line. The same construction applies to the converse case of converting a time-pressure into a distance-pressure diagram.

(1) Taking first examples of simple theoretical diagrams, and considering the forward or driving pressures only, it will be clear that if the steam is carried through the whole length of the stroke without expansion, then the two kinds of diagrams will in each case be a rectangle and their mean pressures will be the same. Figs. 26 to 33 are the upper lines of theoretical indicator diagrams for various points of cut off. The expansions are assumed hyperbolic, with a clearance space of 7 per cent. The full line diagram is the true or distance-pressure diagram. The dotted line shows where the time pressure departs from the distance pressure. The shaded area represents the difference between the two. The following table shows a summary of the differences between the two diagrams for a series of cut-off points between 0·2 and the end of the stroke:

TABLE 1.

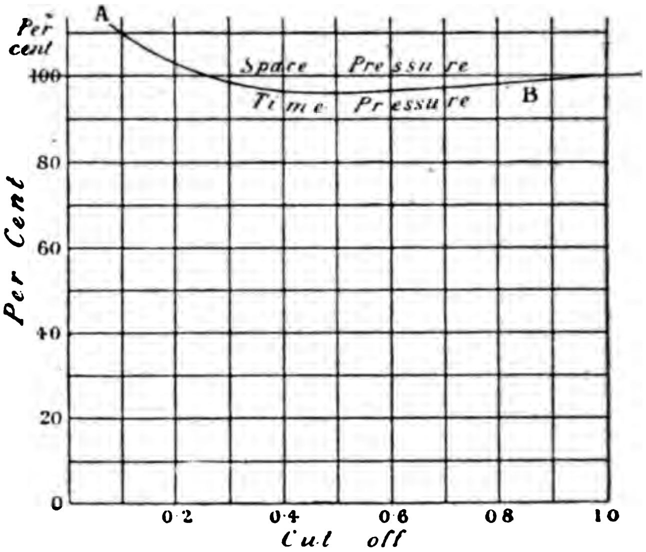
Point of Cut-off.	Percentage difference reckoned on the mean absolute forward pressure.
0·2	+ 2·9 per cent.
0·3	— 1·4 „ „
0·4	— 3·5 „ „
0·5	— 3·9 „ „
0·6	— 3·4 „ „
0·7	— 2·6 „ „
0·8	— 2·1 „ „
0·9	— 1·1 „ „

Average percentage difference throughout the range from 0·2 to end of stroke = — 1 88 per cent.

Fig. 34 shows the same facts by means of the curve AB. The difference intercepted by the vertical between the 100 per cent. line and the curve AB through any point of cut-off on the base line represents the difference per cent. at that cut-off, between the two kinds of mean pressure for the forward or driving stroke of the piston. Fig. 35, 36, and 37 show further results under various conditions.

Fig. 38 shows that if the top line of the indicator diagram slopes uniformly from admission to release—which is the tendency, more or less, in high-speed engines—then the positive area which increases the time-pressure diagram in the first half of the stroke is neutralised by the negative area in the latter half of the stroke, and the two means are in this case equal to one another.

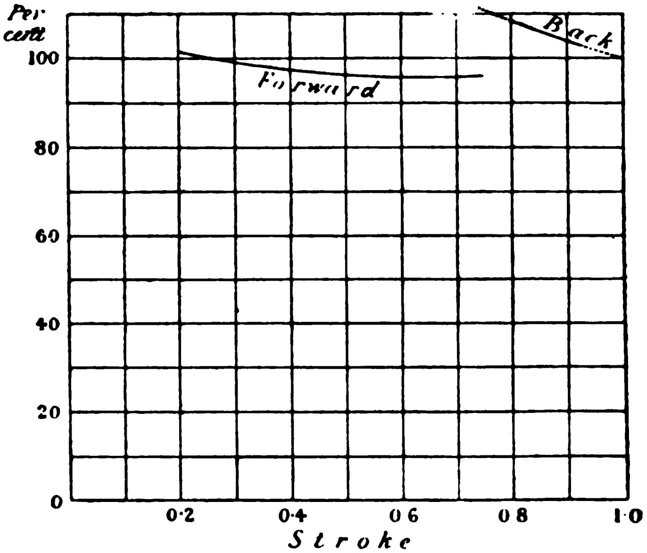
Fig. 34.



Considering the back-pressure line, it will be seen from Figs. 39 to 42 that the compression corner introduces a more or less large difference between the time pressure and the distance pressure for the bottom line of the diagram, and that the larger the compression the greater the difference between the two. The full lines of the Figs. 39 to 42 are the bottom lines of the diagrams as they would be taken by an ordinary indicator. The dotted curve is the time pressure curve. The shaded area shows the difference between the two, and represents the amount by which the time pressure differs from the distance pressure.

Where a large compression occurs with an early cut-off, as in link motion engines, then both the upper and lower lines of the diagram show a high reading on a mean pressure gauge, but being both plus results the errors tend to neutralise each other, Figs. 43, 44, and 45. Fig. 43 is the indicator diagram

Fig. 50.



when the valve gear is linked up to nearly mid-position. Fig. 44 is the top line of the diagram, and Fig. 45 is the bottom line. It is here seen that for this somewhat extreme case the error between the gauge reading and the true mean-pressure is the same in kind for both the top and bottom lines of the diagram, and that the net difference is - 1·86.

(2) Turning now from theoretical to actual diagrams, the relation between the two kinds of diagrams taken from indicators A and B respectively (Fig. 16) was obtained over a full range of powers. Figs. 46, 47, and 48 are examples of those obtained by the ordinary indicator, and Fig. 49 represents a corresponding time-pressure diagram. The relation between the two is shown, Fig. 50, by means of curves as percentage of the true diagram. It will be seen that the forward pressure line of the time-pressure diagram is always a little low, averaging throughout the trials here given a difference of - 3 per cent. The back pressure is shown by the short line to the right of the figure and averaged 5·5 per cent. above the true back pressure. The shaded areas marked 1 and 2 (Fig 49) distinguish between the compression area (1) and the lead area (2) on the back-pressure line of the diagram.

Trials of the Mean Pressure Indicator.—For the purpose of determining the true ratio between the indicator and the mean-pressure instrument for any given engine or type of engine, if ordinary indicator diagrams be taken at varying loads, and the result be then compared with the reading by the gauges of a mean-pressure instrument, the relation between the two can be noted, and the average difference throughout the range of loads determined once for all. The extent of this difference in practice may be seen from the following series of trials made on the experimental engine at University College, Sheffield (Fig. 51). The engine is of the marine type with compound cylinders 10 in. and 18 in. diameter, and 12 in. stroke, fitted with a link motion valve gear and a surface condenser. Average revolutions 100 per minute, boiler pressure 80 lbs. per square inch. The indicator diagrams, Figs. 46 to 48, are sample diagrams taken during the trials, and are numbered by letters to correspond with the letter number of the trial. The experiments were made on the high-pressure cylinder of the engine working under light, medium, and heavy loads, and under varying ranges of expansion, numbered, full steam, first grade, and second grade. The indicator diagrams were taken with Tabor indicators, the springs of which were tested before and after the trial and found correct. The pressure gauge readings were measured by means of a Schäffer & Budenberg duplex standard test gauge for the driving pressures, and by a specially standardised large dial gauge for the back pressures.

From Table 2 it will be seen that the readings of the forward and backward pressure gauges when compared with the indicator diagrams showed an average difference of — 3·1 per cent. for the forward pressure, and of — 1·4 per cent. for the backward pressure, or a net difference of — 1·7 per cent.

If it is desired to avoid the use of factors, the forward and backward pressure gauges may be graduated as shown in Fig. 20, the scale being increased by the required per cent. of the absolute pressure. The true mean effective pressure may then be read direct from the gauges without any further correction by taking the difference between them to within a limit of error not greater than 1 per cent.

It is probable that this average percentage correction will

TABLE 2.

Successive Trials, taken 25th November, 1898.

No. of Trial.	Forward.			Back.			M.E.P. Time.	M.E.P. Distance.	Difference.
	Reading by Forward Pressure Gauge. abs.	Mean Forward Pressure by Indicator. abs.	Difference.	Reading by Back Pressure Gauge. abs.	Mean Back Pressure by Indicator. abs.	Difference.			
				Block at the End of the Link.					
A	34·7	35·5	— 0·8	13·7	14·5	— 0·8	21·0	21·0	0
B	32·7	34·6	— 1·9	13·5	14·0	— 0·5	29·2	20·6	— 1·4
C	39·7	41·5	— 1·8	18·2	19·4	— 1·2	21·5	22·1	— 0·6
D	40·7	41·8	— 1·1	17·7	18·5	— 0·8	23·0	23·3	— 0·3
E	44·7	45·9	— 1·2	18·7	19·2	— 0·5	26·0	26·7	— 0·7
F	44·7	46·6	— 1·9	18·7	19·2	— 0·5	26·0	27·4	— 1·4
		Mean	— 1·5 or — 3·8 %			— 0·7 or — 4·2 %			
				First Grade Expansion.					
G	39·8	42·6	— 2·8	21·1	22·2	— 1·1	18·7	20·4	— 1·7
H	40·2	41·9	— 1·7	21·5	22·2	— 0·7	18·7	19·7	— 1·0
J	46·0	47·6	— 1·6	23·7	23·5	+ 0·2	22·3	24·1	— 1·8
K	45·5	46·7	— 1·2	24·2	24·5	— 0·3	21·3	22·2	— 0·9
L	51·7	52·6	— 0·9	25·2	25·5	— 0·3	26·5	27·1	— 0·6
M	50·5	51·4	— 0·9	25·7	26·4	— 0·7	24·8	25·0	— 0·2
		Mean	— 1·5 or — 3·3 %			— 0·5 or — 2·1 %			
				Second Grade Expansion.					
N	50·2	52·0	— 1·8	35·2	33·8	+ 1·4	15·0	18·2	— 3·2
O	50·2	51·7	— 1·5	36·0	35·5	+ 0·5	14·2	16·2	— 2·0
P	53·7	54·3	— 0·6	36·2	35·1	+ 1·1	17·5	19·2	— 1·7
Q	54·7	55·7	— 1·0	37·0	36·1	+ 0·9	17·7	19·6	— 1·9
R	55·7	56·7	— 1·0	36·7	35·8	+ 0·9	19·0	20·9	— 1·9
S	55·2	56·3	— 1·1	37·7	37·6	+ 0·1	17·5	18·7	— 1·2
		Mean	— 1·2 or — 2·2 %			+ 0·8 or + 2·2 %			

Mean difference throughout the whole range forward = — 3·1 per cent.
" " " " backward = — 1·4 "
Net difference " " " " = — 1·7 "

vary for different types of engines, but experience with the instrument will determine the factor or gauge correction necessary for any given type.

Readings by Pressure Gauges.—In order to obtain a reading of the mean pressure acting upon the gauge, the writer employs two throttling cocks, one close to the instrument and one more or less close to the gauge. By the use of these regulating cocks the oscillations of the finger of the gauge may be reduced to any desired degree of steadiness without interfering with the accuracy of the reading of the mean pressure.

It is not unlikely that some engineers will object *ab initio* to the arrangement described in this paper, seeing that it is proposed to obtain such an important value as the mean effective pressure in an engine cylinder by means of an appliance so unreliable as the pressure gauge is said to be, by some authorities, and still more so when it is proposed to throttle the steam supply to the gauge, as has just been described.

But in answer to these objections the writer desires to give the results of his own experience, as, having himself been in doubt as to the accuracy of gauges and the effect of throttling,

Fig. 21. *Ordinary Indicator attached to Mean Pressure Instrument.*

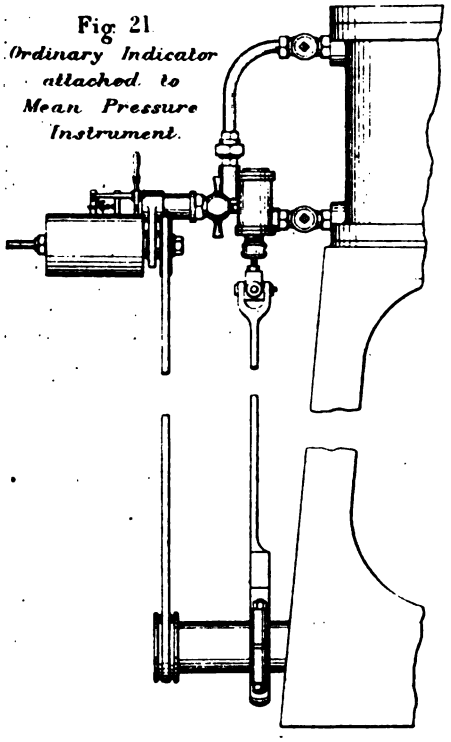


Fig. 22. *Forward and Back Pressure (not separated).*

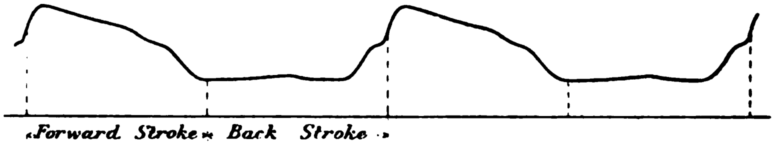
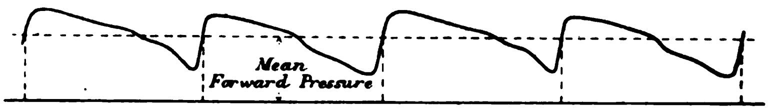
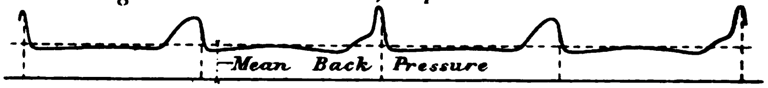


Fig. 23. *Forward Pressures, top and bottom.*

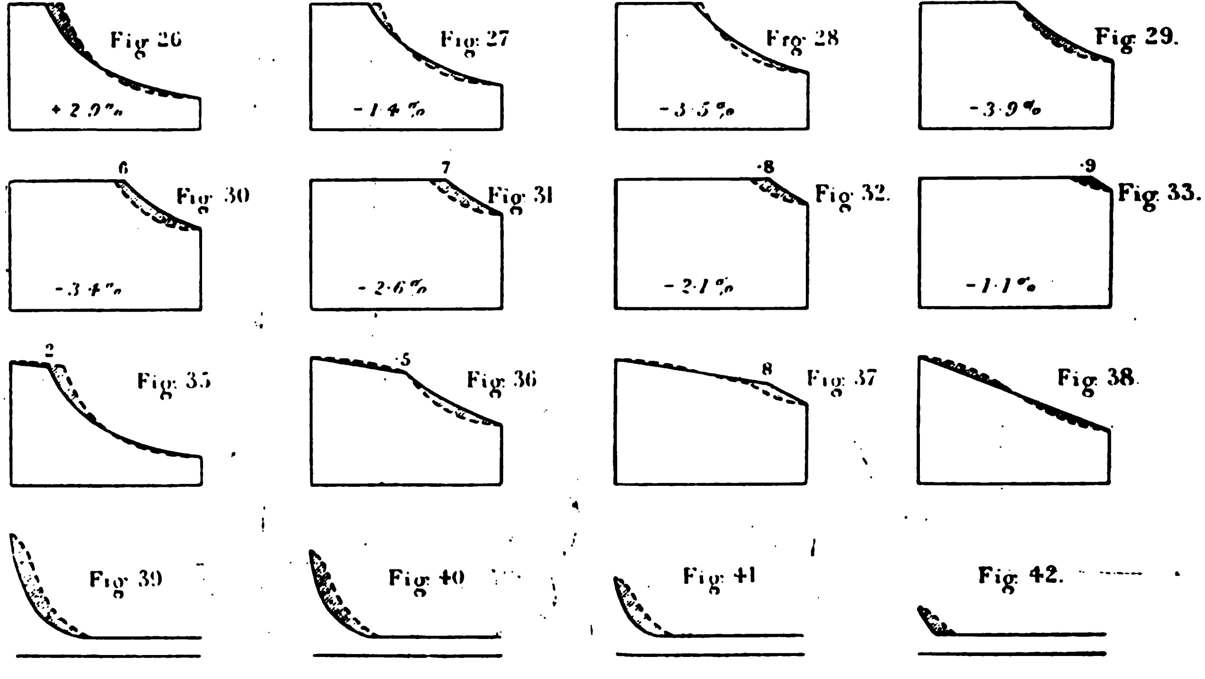


Scale 1/108th

Fig. 24. *Back Pressures, top and bottom.*



Theoretical Diagrams showing the relation between Time-Pressure and Distance-Pressure.



he has made many hundreds of experiments in order to test the extent of the error to be expected, and he has come to the conclusion that readings by a pressure gauge may be obtained which are as accurate, as consistent, and as reliable as by any known instrument for the measurement of pressure, not excepting the best of indicators; also that the throttling, when properly applied, does not endanger the accuracy of the reading, but on the contrary gives the true mean effect of the regular successions of momentary variations of pressures acting on the gauge.

In order to obtain accurate readings by means of a pressure gauge, such gauge must (1) be properly constructed; (2) be properly used. That a large number of the pressure gauges in ordinary use in practice are more or less unreliable is well known, but it will be admitted that such gauges, of the unreliable class, have not been constructed for the purpose of extremely accurate measurements, and have not received that care in the process of manufacture which is necessary to enable them to be classed as "instruments of precision." Their deficiencies are usually not due to defect in the principle upon which they are constructed, but are rather a question of quality of manufacture. But, however perfectly constructed a gauge may be, it is of course necessary that it should be carefully used, if it is to be expected to give uniformly accurate readings. Probably no instrument used by engineers receives such scant attention as the pressure gauge, and, while some of our measuring instruments must be carefully cleaned, oiled, and set, before we may have a single measurement, the pressure gauge may be dirty or rusty, or hot or cold, or its syphon may be empty or full, but under all these conditions it is expected to be equally accurate.

Relation between Time-Pressure and Distance-Pressure.

Fig. 43

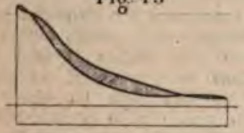


Fig. 44. *Forward Pressure*

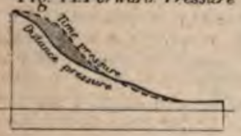
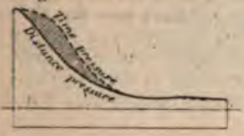


Fig. 45. *Back Pressure*



Mean Forward Distance-Pressure = 44·04 *abs.*
" " *Time* = 47·16 *abs.*
+ 3·12 *lbs*

Mean Back Distance-Pressure = 37·5 *abs*
" " *Time* " = 42·48 *abs*
+ 4·98 *lbs.*

Mean-Effective Distance-Pressure = 6·54
" " *Time* " = 4·68
Net Difference = −1·86 *lbs*

Fig. 46. *Trial F, Table 2.*

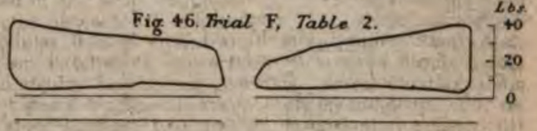


Fig. 47. *Trial L*

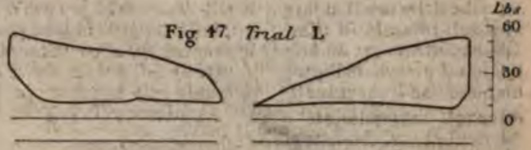


Fig. 48. *Trial R.*

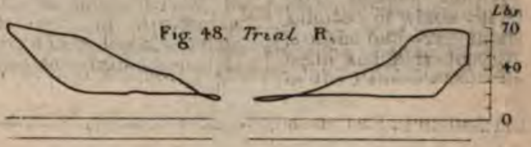
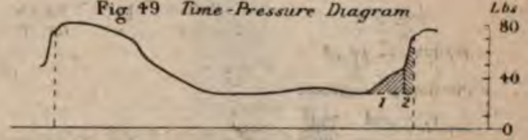


Fig. 49 *Time-Pressure Diagram*



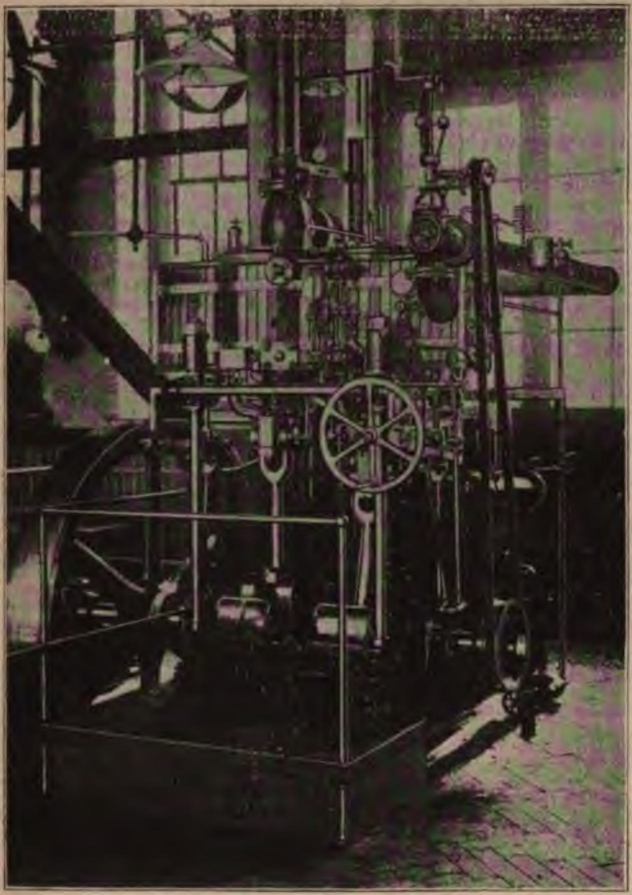
Mechanical Engineers 1899.

Pressure-Gauge Syphons.—The importance is admitted of maintaining a column of water in the syphon of the pressure gauge to keep the gauge cool, so that its readings may be consistent, and so as not to subject the gauge to high or variable temperatures. It is generally supposed that if the gauge has a syphon there is always water in it, and that when the syphon is once full of water, the water is easily retained therein, but these assumptions are not warranted by the facts of the case. The water will disappear from the syphon from various causes: (1) If there is the smallest leak in the gauge end of the syphon; then the water is all gone in a minute or two by being blown out by the steam, though the leak may be almost imperceptible. (2) If the pressure to which the gauge is subjected is a variable one, as is the case when the gauge is attached by its syphon to the valve chest of an engine regulated by a throttling governor; then the water will disappear from the syphon as usually constructed in a few minutes, especially on a sudden reduction of load, and consequent fall of pressure, in the same way that water in the engine cylinder disappears during expansion and exhaust. (3) When the gauge is liable to be subjected to a vacuum, as is the case when it is attached anywhere on the engine side of the throttle valve; then if the throttle valve is closed by the governor, or by hand, whilst the engine continues running, especially if it is a condensing engine, the engine becomes an air-pump and the water in the syphon is displaced by the expanding air initially contained in the spring tube of the gauge and its connections. Thus if the pressure in the engine falls to 3 lbs. absolute, the volume of water displaced in the syphon equals 15 ÷ 3 = 5 times the volume of air in the gauge. If now the steam is again suddenly turned on the engine, it is certain that the gauge readings will be different from what they were when the syphons were full of water. When there is water in the syphon the syphon pipe is practically cold with a steady pressure. When the pipe is very hot the water has probably gone from the syphon, unless it happens that the pipe is in contact with some hot metal. (4) If the gauge is subjected to a vacuum, and there is the smallest leak in the fittings at the gauge end of the syphon, then the water in the syphon is displaced by the air which enters the syphon through the leak.

To Prevent the Disappearance of Water from the Syphon.—(1) When the cause is due to the variable nature of the pressure acting on the gauge the water may be retained in the syphon by the method of double throttling already mentioned. When the mean pressure instrument was first constructed, only a single cock was fitted to the syphon of each pressure gauge,* and great difficulty was found in keeping the water in the syphon. Many devices were tried to overcome this difficulty, but without avail. A second cock would have been fitted at an early period of the experiments, at the end of the syphon farthest from the gauge—which, when throttled, would instantly have stopped the trouble—but for the fact that the writer set out with the notion that, if the throttling of the syphon cock was a throttling of water, the pressure would be

---

* See Proceedings, Institution of Mechanical Engineers, 1897, page 317 and plate 76.



Experimental Engine at University College, Sheffield. Fig. 51.

transmitted to the gauge undiminished; but that, if the throttling took place in the steam, a loss of pressure would follow, and the reading of the gauge would be low. This erroneous notion cost about twelve months' experimenting to try to discover how to do without the use of water in a syphon.

One of the devices tried by the writer to overcome the difficulty may be of interest. A differential pressure gauge was constructed, as shown in Fig. 52. The driving pressure steam was admitted from the mean pressure indicator valve-box A by the pipe B against the piston C. The back pressure was admitted by the pipe D against the piston E. The pistons C and E were attached to the same rod, which was made an easy fit to prevent friction as far as possible, and the movement of the piston was regulated by the indicator spring F. To prevent violent motion of the pistons a dash-pot G was added which was filled with oil, and its piston was also made to work quite smoothly. Holes were made beyond the pistons C and E to allow of the free escape of any steam which might pass the pistons. The method of transferring the movement of the pistons to the finger of the gauge will be understood from Fig. 52. This instrument was not satisfactory, as it was not sufficiently sensitive, and a further attempt was made to improve the action of the water syphon.

Fig. 53 shows the arrangement employed for experimenting on the effect of double throttling. A short water-gauge glass A is secured between two plates B and C held together by bolts. The glass is connected at the top with the engine cylinder D by the pipe as shown, and at the bottom of the glass the gauge pipe is attached. There are regulating cocks at E and F. When the cock E is opened wide and the engine is running, the change of pressure in the cylinder between the driving and the exhaust stroke caused a more or less violent agitation of the water in A, being the more violent as the range of pressure was greater. When the range of pressure was not more than about 10 lbs. the water in the glass was quiet, but when the range of pressure exceeded this (by increasing the load on the engine) agitation again began. The action appeared to be due first to the heating of the water in the tube by the rush of steam, mixed with globules of hot water, into the tube; and, secondly, to the re-evaporation of the heated water when the pressure fell during expansion and exhaust in the cylinder. It is not possible to give numerical data as to the effect of different ranges of pressure because the behaviour of the water was most erratic. Sometimes with a given range of pressure in the engine, the water was violently agitated, and would disappear from the

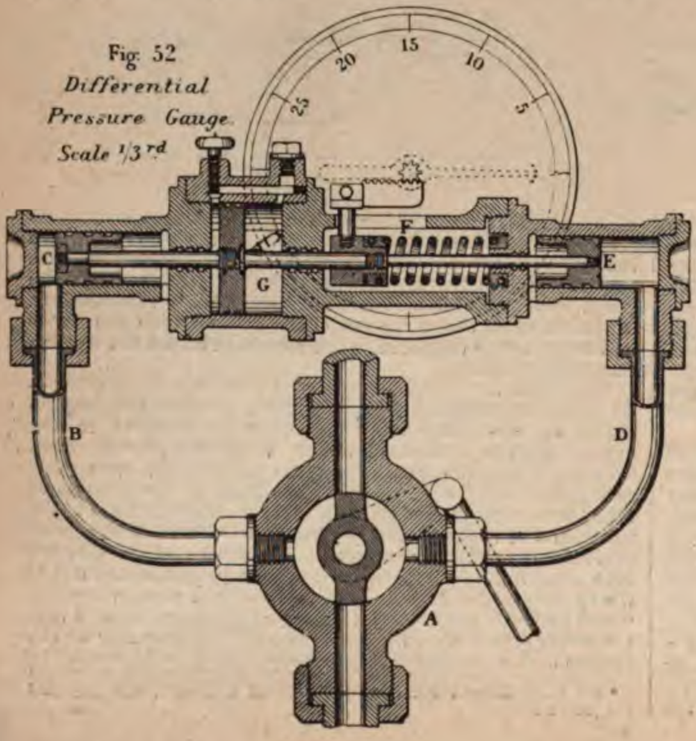


Fig. 52
Differential Pressure Gauge
Scale 1/3rd

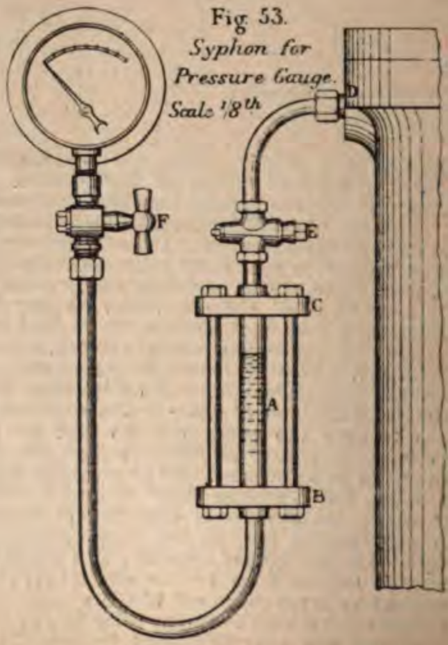


Fig. 53.
Syphon for Pressure Gauge.
Scale 1/8th

glass in a few minutes; in other cases it would remain quiescent in the glass for hours, though the conditions appeared to be unchanged. Then it would suddenly commence to boil and to disappear without any apparent cause. But in all cases of agitation of the water in the tube A, when the cock E was throttled down the agitation immediately ceased.

The amount of throttling of the cock E which was necessary to stop the agitation still left a fairly large movement of the gauge finger across the scale, and the final adjustment for steadying the finger to the smallest possible movement was obtained by throttling the cock F. Throttling the cock E had no effect on the pressure reading by the gauge unless the throttling was carried too far. It was not necessary in order to stop the ebullition to throttle the cock E so far as to reduce the pressure. If any doubt remained as to whether the cock E was throttled too much, a little more opening of E would show at once whether such was the case. But it is only necessary to move E sufficiently to stop the ebullition and consequent disappearance of the water, and this leaves a good margin before the throttling of E is excessive.

With such an arrangement the effect of suitably throttling the cock E is to automatically fill up the syphon, if partly empty from any cause, and the water in the syphon will thus reach as far as the cock E when the apparatus has been at work a short time. In this way the problem of keeping the water in the syphon continuously and free from agitation was solved, and there is now practically no difficulty in obtaining a constant and accurate reading of the mean pressure by gauges subjected to variable pressures.

(2) When the cause of loss of water in the syphon is due to the gauge being subjected to a vacuum, a type of gauge is preferable from which the air in the Bourdon tube has been excluded, and the tube filled with liquid to its extremity; there is then no air to expand in the tube to expel the water from the syphon.

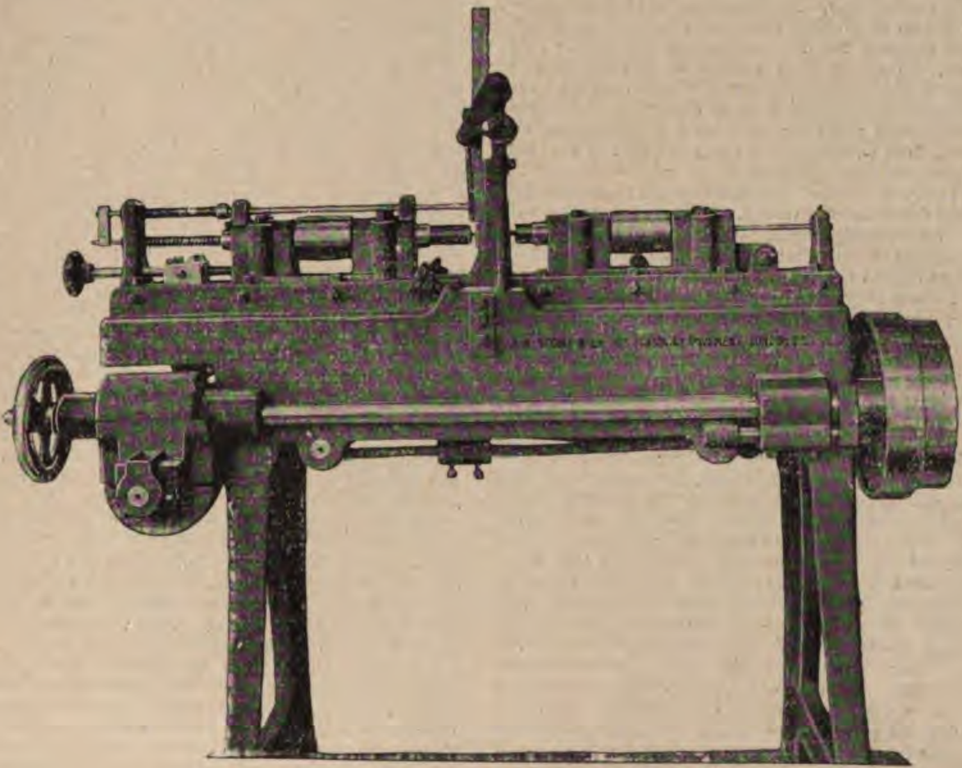
To sum up:—(1) The instrument here described gives a correct record of the mean time pressure. (2) The mean time pressure bears a definite ratio to the mean pressure as given by an ordinary indicator. (3) The correction may be made by the use of a factor, or by a corrected scale on the gauge dial. (4) Pressure gauges when properly made and properly used may be relied upon to give accurate readings.

In conclusion, the author wishes to acknowledge his indebtedness to his assistant Mr. J. W. Kershaw, M.Sc., who has rendered considerable help in carrying out the experiments

AUTOMATIC PLUG MAKING MACHINE.

We give an illustration of a machine of unique and recent design for making all kinds of cross-grain wooden plugs, which will be found a valuable addition to any factory where this class of work is required, especially shipbuilders.

It is very simple and extremely quick in its action. As an instance of its capacity, 10,000 plugs may be made in ten hours. The timber is fed in at the top and is allowed to drop by an automatic grip arrangement on to a stop with adjustment for different sizes of plug.



A cylinder saw of the required size is attached to the left-hand headstock, this cuts the plug, and a second bevelled cylinder saw attached to the right-hand headstock cuts a small chamfer on its edge.

While the timber is being worked it is held in position by a rod actuated by a spiral spring, which at the same time controls another spring rod above, and releases the timber after the cut to allow same to drop ready for the next cut.

This machine is perfectly automatic, adjustable everywhere where necessary, and can be immediately set up for making plugs of different thicknesses as well as of different diameters. It will make any size from $\frac{3}{8}$-in. upwards.

For further information apply to Messrs. J. B. Stone & Co., 135, Finsbury Pavement, London, E.C.

THE FLEETS OF THE MAIL LINES.

(*From our own Correspondent.*)

A Constructive Total Loss.

AT the time of its occurrence I mentioned the mishap to the once famous *Gallia*, of the Cunard Line. I told how this vessel, when running for the Beaver Line, had in May last, through a fault which could not be attributed to any of her officers, been stranded on Sorel Island above Quebec, and had a very narrow escape of being left high and dry in a meadow during a Canadian summer, but at an expense of some £6,000 she was got afloat and brought back to Liverpool, There she has lain ever since. At the recent Liverpool Assizes, an action was tried as to whether or not the owners could make the underwriters account for the matter on the basis of her being a total loss. She had been bought by the managers of the Beaver Line in 1897, for £23,250, and it now appeared that she had sustained such injuries that, if she were thoroughly repaired at a cost which the jury estimated would amount to £8,500, she would then be worth only some £14,000. That being so, and her value as old iron being not so very much short of her repaired value, it was concluded that she was not to be repaired, and must be paid for as a total wreck. Thus is doomed a very well-known and exceedingly popular Cunarder of twenty years ago. It is interesting to note that much of the damage which she sustained was due to the trying experiences to which her boilers were put when they were necessarilly filled, when heated, with cold water, her feed pipes at the same time being choked with grass which was floating down the river at the time. Their condition was so bad after this unaccustomed usage that one of her engineers said they had difficulty in getting steam at all on the homeward trip.

Messrs. Donald Currie & Co.,

whose fleet is doing so large a share of the national work of carrying out the troops for South Africa, have issued a very pretty and well got-up little pamphlet, giving pictures of the Royal Mail packet *Kildonan Castle* and of the other liners which are in employment as troopers. The *Kildonan Castle*, as is now generally known, is the sister ship to the *Kinfauns Castle*, whose cruise from the Clyde to Southampton I noticed in this column a few months ago. She was only launched on the 22nd August, yet she has already landed at the Cape the largest number of troops ever sent out in one bottom. The actual figure was about three thousand men. The illustrations show the *Kildonan Castle* as she was launched, as she is with the troops' accommodation in the 'tween decks, and as she will be when fitted for passenger service in the style described in the account of her sister. A very present interest attaches, too, to the pictures of the accommodation provided for the leading officers of the expedition, for Colonel Gough aboard the *Braemar Castle*, for General Buller on the *Dunnottar Castle*, and for the officer in command of the troops on the *Lismore Castle*. The view of the embarkation of General Buller on the *Dunnottar Castle* promises to become historical, and that of the departure of three Castle liners with troops from Southampton at one time is as interesting an evidence of the resources of the company as it is an excellent piece of photographer's work. The little pamphlet, which is thoroughly well written, is completed by the addition of a coloured map of South Africa. As an instance of Sir Donald's great thoughtfulness, it may be mentioned, that as a little souvenir of the event, he presented a copy of the booklet to every soldier who made passage on her in this her maiden trip. I have heard, too, that those who helped to get her ready for service with such unprecedented despatch, were also furnished with similar mementoes.

The Transport Service

is now employing steam tonnage amounting to nearly eight hundred thousand tons. This is of course contained in bottoms of great size, ranging, as the vessels do, from three to ten thousand tons. Taking into consideration vessels of small tonnage and obsolete type, which would be unfitted for any service of the kind in which our vessels are employed, the whole steam fleets of the mercantile marines of only three foreign Powers equal this total. The three nations in question are Germany, France, and the United States. Though the aggregate tonnage of the two last-named does exceed on the total at present engaged by the British Admiralty, it does so only very slightly; and it is fair to say that the combined mercantile marines of the world—outside our own—could not have undertaken the task which ours has fulfilled. Yet the ships of the Red Ensign have done it without to any very appreciable extent disarranging their ordinary work. This is the advantage of the sea-power of England, and the lesson which the fact teaches should not be allowed to pass unnoticed.

Such a work could not be expected to pass without some casualties, but so far there has fortunately been no loss of life, though some destruction of property and of much-needed war material has been suffered. The first accident was that to the *Rapidan*, which encountered heavy weather in the Irish Sea and put back to Liverpool with the loss of about 250 horses. Then came the loss of the *Ismore*, a fine screw steamship, of 5,216 tons gross register, on the rocks off Columbine Point, St. Helen's Bay, Cape Colony, when she was but 80 miles short of her destination. The *Ismore*, which was Transport No. 52, was a new ship, having only been launched on the 12th April, 1899, by Messrs. Barclay, Curle & Co., Glasgow. She carried, besides her crew, 346 troops, belonging to the 10th Hussars, the Royal Army Medical Corps, and the 63rd Field Battery. She also had about 250 horses. After she struck, things looked serious; the ship was fast settling on the rocks, and repeated voyages of the boats were needed to put the full ship's complement ashore. But the same discipline which characterised the brave soldiers who went down in the *Birkenhead* in 1852 had trained the men of the *Ismore*, and they waited patiently for their orders, prepared to show that they were worthy of their traditions, and that the half century which had passed since that terrible, if glorious, episode had not weakened the discipline or impaired the courage of the British trooper. Fortunately, the science of to-day, if it could not save the ship, at least prolonged the period of her dissolution sufficiently to allow of the landing of all on board. Some war material and some twenty horses were also saved, but there seems no further hope of salvage. A ship, however good, can be spared even at this crisis, but the loss of the trained cavalry-horses in the *Rapidan* and the *Ismore* is a more serious matter, since it takes time to replace them. Another Government loss is that of the Ropner liner *Maltby*, stranded at the mouth of the Tyne when outward bound to the Cape with a full cargo of coal for the transport fleet. She struck the Black Middens, and, though the crew were taken off by the rocket apparatus, she soon parted amidships, and, with her cargo, is a total loss. She was a ten-year old steel boat built at Stockton by Messrs. Ropner & Co., and fitted with triple-expansion engines by Messrs. Blair & Co. Fourthly comes the stranding of the Houlder Line s.s. *Denton Grange*, outward bound from Southampton, on the 5th December. with a very heavy and important cargo for Cape Town. She struck at Santa Catalina when entering the port of Las Palmas on the 11th December. She had upwards of seven thousand tons of most valuable stores aboard. Comprised in the list were large quantities of oats and hay for the cavalry horses; water-pipes for the use of the camps; steam traction-engines, steam ploughs and in short a miscellaneous assemblage of matters which were calculated to be of extreme use to our forces at the front. The vessel came broadside to the breach and H.M.S. *Furious* failed in her attempt to float her. The salvage s.s. *Herakles* was at once despatched to her assistance from Gibralter, and measures were taken to secure the safety, in any event, of the horses which formed part of the freight. The *Denton Grange* was built, three years ago, of steel, by Messrs. Workman, Clark & Co., of Belfast. She is of about 5,800 tons gross register and was fitted with seven bulkheads, and triple-expansion engines driving a single screw.

The Dominion Line

still continues to add to its fleet. The latest addition reported is the twin screw s.s. *Brasilia*, which has been acquired from the Hamburg-American Line, who used her in their Baltimore trade. She is a vessel only two years old, built and fitted with quadruple-expansion engines, by Messrs. Harland & Wolff, of Belfast. The vessel is of over 500 ft. in length, and her beam and depth are 62 ft. and 38 ft. respectively, whilst her gross tonnage exceeds 10,000 tons.

The White Star Line

is well represented amongst the transports. To the *Medic* with the Australian contingent, and the *Nomadic* and *Britannic*, which sailed amongst the earlier ships taken, have been added the mail steamer *Majestic*, and the reserve steamship *Cymric*, which latter has the distinction of being the biggest ship in the transport fleet, if she cannot claim the *Majestic's* Atlantic speed. Through their patriotic response to the call of the Admiralty, the White Star Line will, I fear, be somewhat handicapped in the Atlantic competition during the next few months, as for a sailing or two they will have to make their dispatches of passenger-ships to New York but fortnightly. But no one must expect to see the *Majestic*, which left Liverpool for the Cape amid a scene of unparalelled enthusiasm on the 18th December, break the Cape record. The Post Office had encouraged the belief that she would do so by circulating a paragraph to the effect that the fast White Star mail steamer *Majestic* would take out a special mid-weekly despatch of letters for South Africa; but the Admiralty effectually put the stopper on any attempt at pacing, for the vessel was so laden when she started that she was reported to be drawing no less than 29 ft. forward. It is unnecessary to remark here that with such a draught she will do nothing like her usual 20 knots. It is well that this point should be borne in mind, for it is certain that after comparisons will be drawn, to the disadvantage of Atlantic boats, between their performances over their 3,000-mile course and those of Cape boats—and of the *Majestic*—over the double distance to the Cape. For answer it need only be said that the chartered steamers of the Cape lines themselves have none of them done on their transport voyages anything like the speed habitual to them when running for their own owners. Admiralty conditions are such that no comparisons should be drawn from what Atlantic boats may not do at this time.

The sailing of the *Majestic* was attended with one matter which should not be lost sight of. A soldier fell from the ratlines of the steamship as her engines began to move, and the big vessel drew away from the stage. His fall was witnessed by one of the ship's cooks, Morris by name, and in spite of the bitter cold and the danger—which as a member of the ship's crew he would be one of the first to realise—of being cut to pieces by the screws, he pluckily went after him and saved him from sinking till help was forthcoming. This feat of Morris's is one which will not be forgotten, and which is fully worthy of being coupled with that of Lieutenant McKinstrey (then not yet promoted to command) on board the *Teutonic* at the Spithead review of 1887. We may rely on it that the firm whom Morris serves will take very good care that his bravery obtains public recognition. The *Majestic's* list comprised somewhere about 2,100 officers and men, whom she ought to land at Capetown ere these notes are in my readers' hands.

The "Gaspesia."

In the November issue of these notes I mentioned that the *Gaspesia*, late of the Canadian Steamship Company, was again offered for sale. Never more will be threatened by her the supremacy of New York as the mail port of North America. She has been sold to Italian shipbreakers, and has already arrived at Genoa on her final trip, for at that port she is to be broken up.

The Compagnie Generale Transatlantique.

The latest addition to the mail fleet of this company is *L'Acquitaine*, a fine 8,000-ton twin-screw steamship, built at Fairfield, and better known as the *Normannia*, though her more recent designation has been the *Patriota*. She made a name for herself in the express service of the Hamburg Line, and at the time of the Spanish-American War was purchased by the Government of Spain for use as an auxiliary cruiser. For that service, however, she was never completed, and after the war was acquired by her present owners. They thoroughly refitted her, and at the beginning of November sent her out for a trial trip. Now she has joined the New York service, sailing from Havre on her first trip on the 9th December, under the command of Captain Poirot.

The German Steamship Companies

are determined to lose no opportunity of increasing their comforts for the travelling public. An entirely new form of luxury for tropical climates has been devised for passengers. This is nothing less than the connection of the passenger accommodation with the refrigerating chambers, so that cool air can be admitted to the living rooms at will. Two of the latest steamships of each of the big companies—the Hamburg-American (whose designation now that it plies to Eastern Asia as well as to North America seems a bit of a misnomer) and the Norddeutscher Lloyd—have been fitted in this way. The latter company has added this month a new 12,000-ton steamer—the *Grosser Kurfurst*—to its fleet. She was built by Messrs. Schichau, of Elbing, and is of the improved and enlarged *Barbarossa* type, that is to say that she is suitable either for the Australian trade or for the intermediate passenger and cargo service to New York.

The "Paris."

A great case was to have been tried at the recent Liverpool Assizes. It was to settle the questions between the owners of the mail steamship *Paris* and the underwriters upon her hull and machinery. Policies had been effected upon her for sums amounting to about £225,000, and the owners, who had abandoned her to the underwriters when she first went on to the Manacles, claimed that they were entitled to refuse to take the ship back, and to demand their full insurance money. The case would have been even more instructive and interesting than that of the *Gallia*, but it never came into court. After the assizes had commenced it was announced that it was settled. The exact terms are not yet known, but it is certain that the shipowners will retain the ship and will repair her, a very substantial sum of money being paid over to them to enable them to restore her to her original condition. It is reported that the work of repairing, re-engining and reboilering the Paris (which will come back to work under a new name) has been given to Messrs. Harland & Wolf, of Belfast.

The "Merrimac."

It was not so very long ago that I chronicled the stranding of the *Merrimac*, near Heath Point, Anticosti, on her outward trip from Bristol to Montreal, a casualty which occurred about the 15th July of the year just concluded. The vessel was apparently in a bad way. She was holed, and the crew had to leave her on the 24th July. Eighty guineas were then paid to reinsure her. But on the 7th August she was floated and taken to Quebec, where it appeared that her injuries were much slighter than the most sanguine had ventured to hope. The same ship is now most seriously overdue. She left Quebec for Belfast on the 25th October, and as long ago as the 15th of November 25 guineas were paid for reinsurances. The premium had risen to 70 guineas by the 1st December, and by the middle of the month had reached 90 guineas. The vessel in question is one of the African Steamship Company's Atlantic cargo-boats. She is a steel screw steamer nine years old, of nearly 4,200 tons gross register, built and fitted with triple-expansion engines by Messrs. Harland & Wolff, of Belfast. She was formerly known as the *Alexander Elder*.

Mr. Brancker.

Liverpool has been paying its due honour to Mr. John Brancker, the chairman of the Mersey Docks and Harbour Board, who, after 29 years' service on the Board, is retiring from the chairmanship. The Lord Mayor of the city presided at a banquet in his honour, and being an excellent speaker, with a very fine subject to deal with, made a very good speech in honour of the good old town's famous citizen and guest. Mr. Brancker's reign at the Dock Board will ever be a memorable one. To him is due—if not all the credit for initiation—at least the honour of having furthered some most momentous changes and some most valuable concessions, alike to the travelling public and to the Dock Board's general customers. Rates have, in his time, been lowered in every direction. Facilities have been introduced for the rapid handling of cargo by the increase in the supply of cranes and in the provision of numerous double-storey sheds. Antiquated docks have been deepened and rendered easier of entrance. The biggest graving dock in the world has been built and brought into use. Upon another dry dock, only inferior to this, work has been commenced. The bar, thanks largely, it is true, to the influence of Mr. G. B. Crow, has been practically abolished. The berths at the landing stage have been rendered capable of accommodating the *Majestic*, the *Lucania*, the *Cymric*, and even the *Oceanic* in turn as each came out. The co-operation of the London and North-Western Railway has been won—partly owing to his influence and partly owing to that of the late Mr. Ismay—it has been induced to discover that the Waterloo Tunnel could be modernised, the Riverside Station has been constructed, and train-to-boat conveniences have been offered by the old port. The Mersey Dock Board's credit stands higher than it ever did. Mr. Brancker retires from his high position full of honour and with the satisfaction of knowing that he has neglected no interests and has honourably fulfilled his trust. His speech at the banquet given in his honour was interesting indeed. He showed that Liverpool did wisely in the year 1857 to dissociate the docks from the control of the municipality. He showed too that municipalities are not good dock managers. Indeed, there are now few ports where they attempt such work. Even important places like Hull and Southampton have their docks under railway control. Bristol seems alone of British seaports of any consideration to still allow their City Council to manage their harbour works, and to regulate the conduct of their shipping facilities. The experience of Bristol of recent years has been singularly unhappy, as has from time to time been shown in these notes. It is not unfair to assume that the vacillating, do-nothing policy which has characterised the management of Bristol docks, and which has driven traffic away from the river, has been largely due to the fact that the management has been centred in a council which, with the best intentions, lacks special knowledge and consists of men chosen for their political opinions, not their aptitude to deal with any commercial questions. Such men are always bound to think of the views which their constituents will take of their votes, and must even unconsciously be swayed by the exigencies of their position.

The Cape Lines, Limited.

On the 15th December, 1899, a most startling and important announcement was published. An arrangement for amalgamation has been reached between the Union Steamship Company and the Castle Mail Packets. The object is to carry out with greater efficiency and economy the contract for the carriage of the Cape Mails, for which the two concerns are jointly responsible to the Post Office. At the time of writing no details as to the terms of the amalgamation are made public. These will be laid before the shareholders of the two companies early in January. But it may well be remarked that the share capital and debentures of each company amount to about a million sterling, though the Union Company has a greater capital and a smaller debenture debt than the Castle Line. The latter's shares, however, stand at a better price on the Stock Exchange. A wide vista of possibilities is here opened out to us. If the amalgamation goes through we shall probably see a mid-weekly sailing of intermediate boats substituted for the double Saturday despatch. But beyond this suggestion it is now too soon to go. Next month I shall hope to give a history of the two companies, of which the elder—the Union Line—dates, as a screw collier company, from the time of the Crimean War. The Castle Line was started in opposition to its now ally about the year 1872. The development of size, luxury, and speed in this trade has been, if possible, more marked even than that noticeable on the North Atlantic. With such men as Sir Donald Currie and Sir Francis Evans at the helm of the amalgamation, it may be taken as certain that want of competition will not arrest progress in the future,

The P. & O. Company

deserves well of the public for the action it has taken in regard to its attempt to prosecute a halfpenny evening newspaper for alleged libel in that it was stated that the transport *Nubia* had been lost at sea with a large number of troops. The attempt to institute a prosecution failed, it is true. But some very strong remarks as to the wickedness of disseminating false news, and of causing an immense amount of needless pain fell from the Bench, and will doubtless be taken to heart by those who achieve a reputation for smartness, and do not mind what trouble or expense they may be causing to the public if only thereby a few halfpence be raked into their own private tills. The judges were probably right in thinking that, under the circumstances, it was unlikely that a jury would consider that an actual libel had been circulated; for juries are taken from the mass of the people, and the feelings of shipping men can hardly be expected to be fully appreciated by them. It was said - and with force—that the loss of such a ship with all hands *might* have taken place without the circumstance causing any reflection upon those who equipped and sent the ship to sea. We all—except a certain body of officials—know that ships are lost in spite of all precautions and that practically all shipowners wish to avoid loss, in spite of insurances. Certainly the managers of great lines which do their own insurance have everything to lose and nothing to gain by such losses. But at the same time it is hardly recognised generally how feminine is the reputation of a ship herself and of the line which runs for passenger traffic. A loss of any kind, even by the purest misfortune, is a slur on the management to the extent, at least, of giving them a reputation for being unlucky. The fact of the loss itself long remains vaguely in the public mind, whilst explanations, however plausible, and causes, however inevitable, are soon forgotten. By the shipping world, therefore, we may be sure that great sympathy with the directors of the P. & O. Company is felt in regard to the wanton statements that were made regarding their vessel, and much gratitude is felt alike by shipowners, by those who go down to the sea in ships, and by relatives of seafarers for the attempt which was made to force some inquiry to be made as to the genuineness of rumours which find their way into newspaper offices.

The Disaster on the Tugela River

will cause a further chartering of transports. The British India steamers *Jelunga* and the *Avoca*, primarily engaged for the Indian relief service, are put on to carry the South African reinforcements. The fine Leyland steamships *Victorian* and *Cestrian* have also been taken up. So too the Elder, Dempster liner *Lycia*, recently sailing between Bristol and the St. Lawrence, has also been engaged. The Cunarder *Umbria*, the Anchor *City of Rome*, and several others are also added to the list. Many of the transports first despatched have now reached this country again, and some of them have already started on their second journey. With the need for further troops, guns, horses, and ammunition it is probable that the demand on the part of the Admiralty for tonnage, already so large, will not for the present be slackened.

The Port of Durban

is doing well in its efforts to cope with the immense influx of troops and stores which are finding their way to Natal. Had not the public spirit of the colonists, who were not then thinking of possible military necessities, rendered the harbour equal to the demands of the day, much needed help might have been delayed to a very serious extent. The people of Durban point with justifiable pride to the fact that the Leyland Line steamship *Armenian*, of upwards of 500 ft. in length and of a draught of nearly 21 ft., passed in safety and without delay over the bar to her wharf.

Messrs. Elder, Dempster & Co.,

with their Canadian mail line, are during the winter season at least, when their ships call at Halifax, about to enter into competition with the Cunard and Dominion Lines for passenger traffic to Boston. It is announced that arrangements have been entered into with the Plant Line, whereby Boston passengers can be taken out by the Canadian mail steamers and transhipped at Halifax to comfortable vessels which will land them at the Massachussets port the day after they leave the Nova Scotian port.

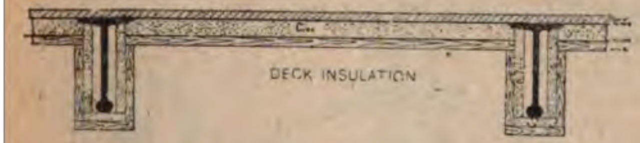
Messrs. Menzies.

the Leith firm of shipbuilders who constructed one of the earliest Transatlantic steamships in the *Sirius*, have just given signs that their enterprise is not blunted by age. They are extending their facilities for taking orders and have acquired a supplementary shipyard at Inverkeithing.

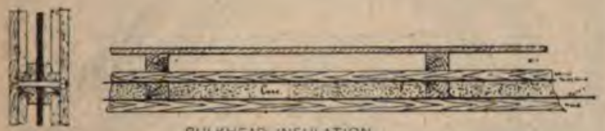
NONPAREIL CORK INSULATION.

AMONGST the many non-conductors of heat that have been known for many years the value of granulated cork has been fully recognised, but the objections to its use have been the expense, the space required, and the fact that all loose materials will, to a greater or less extent, settle and leave unprotected spaces, as is the case with mineral wood, charcoal, sawdust, and other similar materials.

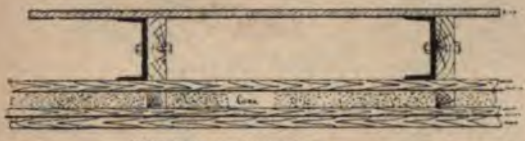
Whilst dealing with the subject of insulation, we should like to again direct the attention of the public to the theory which has been put forward that charcoal, when used as an insulating medium, is often responsible for many of the fires that have occurred on ships that are fitted with cold storage, and particularly with reference to those that carry a frozen cargo on one voyage and a general cargo on the return voyage. It is known that charcoal is peculiarly liable to spontaneous combustion owing to its great capacity for absorbing and condensing gases. Professor Vivian Lewis, in an address delivered by him at a meeting of the British Association at Nottingham, in 1893, observed that carbon is one of those substances which possess to an extraordinary degree the power of attracting and condensing gases upon their surface, and that a heap of charcoal powder of 100 bushels or more will always ignite. He gave as his reasons, that the more porous a body is the greater amount of exposed surface will be available for the condensation of gases, and the great power that charcoal has of absorption is undoubtedly due to its great porosity; and he pointed out the great danger of combustion in a substance prone to such chemical action. As evidence of this fact being fully recognised by the authorities, we have only to point to the stringency of the regulations of the Explosives Act relative to the storage of charcoal in connection with the manufacture of gunpowder. Therefore closely packed charcoal—liable to be wetted on the one hand by leakage from the decks or elsewhere, and on the other exposed to a wide range of temperatures, ranging from zero with frozen meat on board to the heat of the tropics when cargo other than meat is being carried—appears in such conditions to be likely to justify all that is affirmed as to its dangerous qualities.



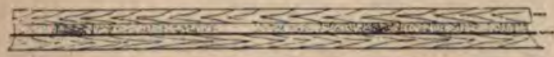
DECK INSULATION



BULKHEAD INSULATION

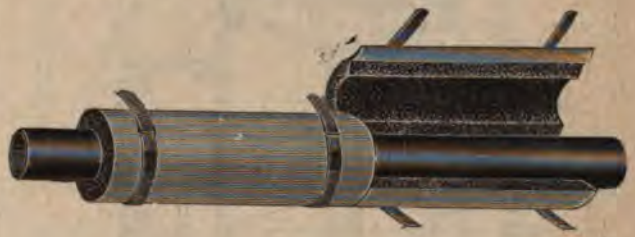


SHIP SIDE INSULATION



The Nonpareil Cork Manufacturing Co., of New York, have placed upon the market a sheet cork insulating medium which is made of granulated cork, so as to produce an efficient article at a commercial price comparable with competitive materials now on the market. The essential feature in the process of manufacture is the treatment of the granulated cork with great heat whilst under pressure. This, by liquefying the natural gum of the cork, and without the addition of any foreign cementing substance, produces a solid sheet or block of cork; and further the pressure forms the interstices between the granules into small closed air spaces, without destroying the myriads of minute air cells which give cork its wonderful heat-non-conducting properties. In the process, 4 in. of granulated cork are reduced to 1 in. As to its efficiency as a non-conductor, tests made by experts in the United States show that with a coating of 1½ in. thickness of magnesia 28 per cent. of heat was lost from a steam pipe carrying steam at 200 lbs. per square inch as compared with the loss from a bare pipe; and with a thickness of 9 in. of Nonpareil cork under similar conditions, only 25 per cent. was lost, which shows that the cork retained more heat with less thickness.

The other advantages claimed for it are: firstly, it cannot disintegrate, as time, moisture, heat, and cold do not affect it; secondly, it is very light, weighing 15 ozs. per square ft., 1 in. thick; thirdly, it can be sawn by hand to fit irregular spaces and is thus easy of application; fourthly, the firmness and regularity of its application ensures its accuracy and renders it practically impossible to slight the work through carelessness or design, which, where loose materials are packed in place often give unsatisfactory results; fifthly, it is odourless and is not attractive to insects or vermin, and, as no foreign substance is used in its manufacture, it is very clean and cannot injure anything with which it may come in contact; and lastly, it is unaffected by vibration and occupies less space than most other insulating mediums.



We illustrate in the adjoining diagrams the usual methods employed for deck, bulkhead, and ship side insulation, also the insulation adopted for use on steam pipes, and we may also mention that this material has been largely used on the following vessels of the United States Navy with successful results, both in the cold rooms and officers' staterooms, the monitor *Monadnock*, the cruisers *Brooklyn* and *Chicago*, and the battleships *Iowa*, *Kentucky*, *Kearsarge*, *Alabama*, and *Illinois*.

The cold storage rooms on the American Liners, *St. Louis* and *St. Paul*, and also the Red Star Line steamers are lined throughout with this Sheet Cork. The results being quite satisfactory to their owners.

The agent in this country is Mr. J. F. Butterworth, of 28, Queen Street, London, E.C.

Notice of Removal.—Messrs. Estler Brothers (late of 27, Leadenhall Street), makers of ships lamps, &c., have removed to larger and more convenient premises at 25, Laurence Pountney Lane, Cannon Street, E.C.

MESSRS. COCHRAN & CO.'S NEW BOILER AND SHIPBUILDING WORKS, ANNAN.

THE large new engineering and shipbuilding works established at Annan by Messrs. Cochran & Co., Limited, who have for many years been established at Birkenhead on the Mersey, have now been in existence practically for 18 months. They represent one way of solving the problem of expansion with which every industrial establishment is at the moment face to face. In almost every direction businesses have been extended, and costly installations of modern plant have been rendered necessary to keep pace with the times. It is not always possible, however, to develop a concern both adequately and profitably, for ground in the outskirts of prosperous industrial communities becomes prohibitively dear, and a dozen other little considerations involve the question. Cheaper ground in less prosperous and less densely populated districts suggests increase in the cost of material, scarcity of labour, and several other difficulties; but one or two enterprises have proved, and others are proving, that, given a suitable situation, most of the drawbacks to pioneer movements of this description are more imaginary than real. The successful transference of a business like Messrs. Cochran's from a populous centre like Birkenhead to a sleepy country town like Annan is a case in point. The new works are better situated in a commercial sense than appears at first sight. Annan is on the Glasgow and South Western main line, and there is a branch from Newbie Junction to the establishment, over which much of the material comes by sea, and is discharged at a wharf on the riverside of the works. At Birkenhead the firm built many small boats of a great variety of types; but in Annan the manufacture of the patent vertical multitubular boiler with which the name of Cochran is associated will probably be developed most. For this purpose the buildings have been more particularly designed, and in point of arrangement and equipment they are model places of the kind. The vertical multitubular boilers were used in the last Soudan campaign, chiefly for pumping water to camping grounds, and at present the works are in full operation day and night completing another order for 18 for use by the British army in South Africa. About 30 or 40 more of both land and marine types are on order for commercial purposes, and when the installation of plant is complete the company hope to be able to stock boilers of every size for immediate delivery. Electric, hydraulic, and pneumatic power is applied to the manufacture in the most up-to-date fashion, and nothing is withheld on any account that can give stability and finish to the work turned out. The ground embraced by the new works extends to about 15 acres, four acres of which are occupied by shops mainly connected with boiler making. The firm have already launched their first vessel the *Ethelinda*, a small steam launch, and this is at present under way. A patent slipway, for hauling up and repairing purposes, is also being laid down, and altogether there are the makings of a very large establishment at Annan.

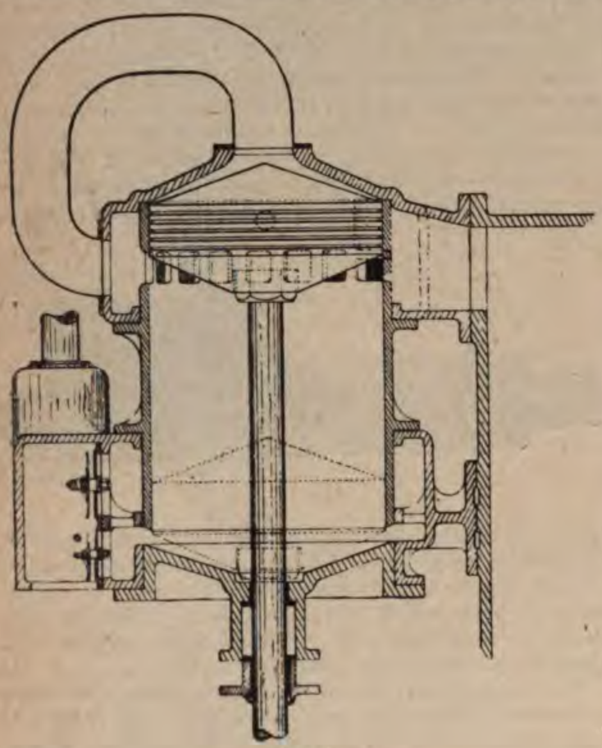


FIG. 1.

DRAKE'S AIR-PUMP.

MUCH thought has been expended of late years upon the air-pumps with reference to their efficiency of action and simplicity of construction and repair. It is now our pleasure to chronicle another departure in this direction, which has been designed by L. H. Drake & Son, M.I.N.A., of 157, Fenchurch Street, E.C., which we feel sure will be of interest to our readers.

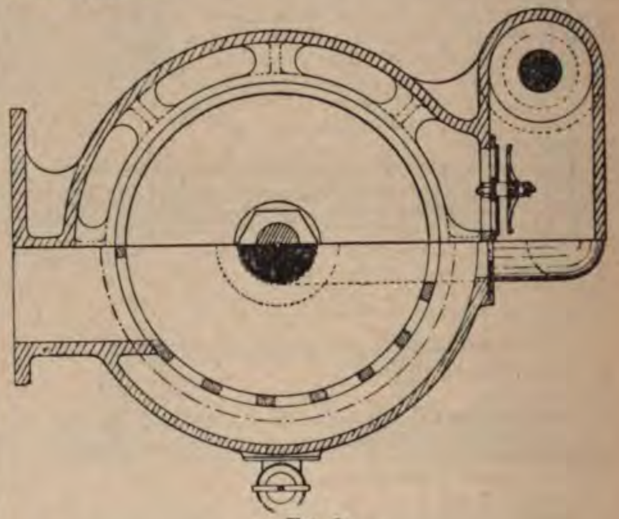


FIG. 2.

We illustrate Mr. Drake's air-pump in the adjoining diagrams, which show two arrangements in sectional plan and elevation.

It will be seen that the special feature of the arrangement is that the pump has no head, foot, or bucket-valves in the pump-chamber. However, there are head-valves only, which are placed on a division plate fitted between an annular water-chamber arranged around the pump-barrel and the hot-well. The pump-barrel is taken down to the bottom of another annular casting, which surrounds it, the bottom of which is conical. This annular chamber forms a water and air chamber. An opening is arranged in the side of the barrel opposite the inlet from the condenser of such a height as to be just opened by the bucket when at the bottom of its stroke. A pipe is taken from the conical bottom round to the annular chamber or passage, and holes are arranged in the barrel communicating therewith. The upper and lower surfaces of the bucket are made conical. The ends of the annular chamber are closed to the inlet to the condenser.

In Figs. 3 and 4 it will be seen that a slight modification is made, inasmuch as the lower annular chamber is dispensed with, and the pipe from the conical discharging direct into a single aperture through the pump-barrel. An air-vessel is arranged on the pipe close to the pump-barrel.

In each case, the arrangement of the valves is such that, in the event of the valves getting out of order, the cover on the top of the hot-well can be removed, and the valves easily repaired or replaced without stopping the engines, or causing any loss of vacuum in the condenser or loss of condensed water, as no doors are required in the pump-barrel.

The operation of the pump is as follows :—Assuming the bucket to be descending, it comes in contact as it nears the bottom of its stroke with the water that has drained from the condenser into the pipe and conical bottom. As the bucket finishes its stroke it displaces the water from beneath it through the pipe and annular chamber on to its top side, and carries it up with it on its up stroke, discharging it by gravity into the top annular chamber and through the valves to the hot-well.

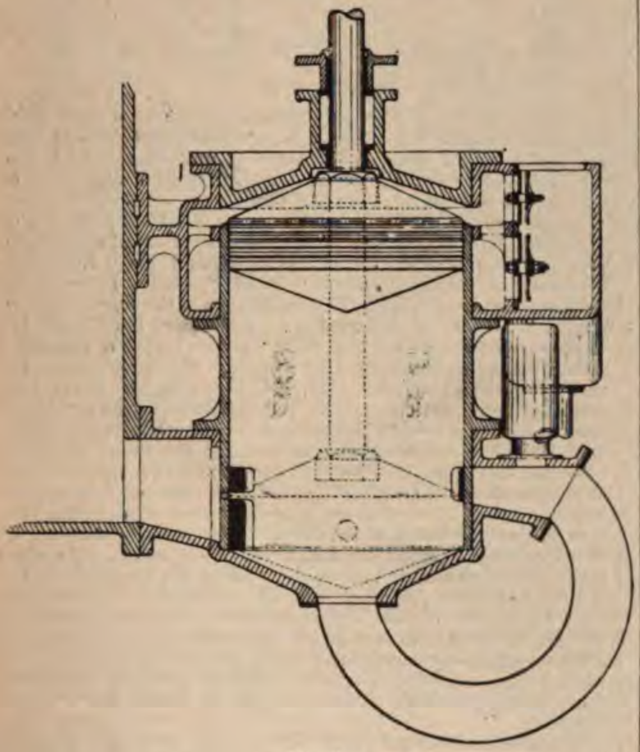


Fig. 3.

Of course, in starting, water and air will be displaced by the bucket and delivered through the head valves ; but, when the initial vacuum has been produced, the pump has practically only to deal with the water and the small amount of air that has leaked through the glands.

We shall be interested to hear the results from the trial of this class of pump.

MARINE ENGINEERS' NOTES.

(*From our own Correspondent.*)

SIR JOHN A. DURSTON presided at the meeting of the Institute of Marine Engineers, held 27th November. Before commencing the business of the evening, he said the country had sustained a great loss by the death of Mr. T. H. Ismay, the head of the White Star Line. He was a leader of men and a captain of industry, and we owed as much to him as to any man living for the development of steam shipping, both in respect of its high tonnage capacity and great speed. He was quite sure the members of the Institute of Marine Engineers would desire to join with him in expressing to the family of the late Mr. Ismay the deep regret with which they had heard of his death, and their sincere sympathy with the members of his family. The motion was carried unanimously, the whole of the members present upstanding.

The paper by Mr. Walter Houfe, on "Objectionable matter which tends to enter steam boilers, and its prevention from so doing" was further discussed. Mr. Halliday asked questions of those experienced in the working of these filters. The point upon which information was specially wanted was whether those feed-filters were of much use. Mr. Hulme, on the last occasion, pointed out that the Turkish towelling, or other material employed to filter the feed-water, generally got clogged up, and there was often great difficulty in getting it cleared with sufficient frequency. Another member said Turkish towelling put in to intercept grease could be easily cleaned, and it proved of great assistance in clearing the feed-water. Mr. Hulme thought the most effectual way of getting rid of grease was by heating the feed-water. Still another member had told them that by turning the exhaust steam on to hot plates, and the feed-water too, all the oil and dirty matter fell to the bottom and could be cleaned out. Sir John Durston said there were three methods of separating grease and other objectionable matter from feed water. Firstly, by the use of material for filtering the water; secondly, by the use of heat for filtering the water; and thirdly, the use of dash plates in the exhaust steam-pipe system. In the Navy they had tried all three methods. They had tried the Turkish towelling system or some equivalent material both in the suction of the feed-pipes and in the delivery feed-pipe. They had also tried it in a large filter tank, above the feed-tank, into which the hot well pump delivered its discharge. The water passed from the filter cloth into the feed-tank, which was the vessel from which the feed-pump took its suction. They had a further system, somewhat similar to the dash-plate, known as Stewart's separator, which was an apparatus containing several dash-plates, but it was only on a suitable plan for the auxiliary machinery of warships, because if applied to the large main engines it required cumbersome castings ; and in the mercantile marine he did not suppose that a plan of the kind would be required at all for the main engines, as they only wanted to trap the water which was used in the auxiliary engines when the engineers

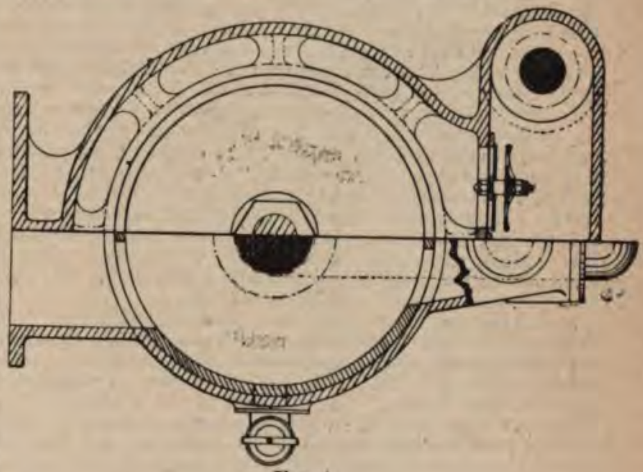


Fig. 4.

had not such a command over the lubrication. They had not tried feed-heaters very much in the Navy, but in the two or three instances where they had been tried there could be no doubt that a great deal of grease was collected in the heaters. The plan which they had largely adopted in the Navy as the result of their experience up to the present was a filter-tank containing a number of cloths; the water was passed into this and then drained away into the feed-tank. One of the things laid down in the Admiralty specifications was that when the engines were first tried alongside a jetty, the contractor was at liberty to use as much oil as he pleased for lubrication, and the air-pump discharge went into the bilges—on this trial the water for the boiler being supplied from the shore or ship's tanks. Mr. Johnston thought it would be better to put in less oil than put in feed filters. The use of oil as an internal lubricant was simply a waste of money. Steam was the best lubricant. Mr. R. D. Keay was presented with the Denny Gold Medal for his paper on "The Thermodynamics of the Steam Engine." Mr. Macartney read a paper on "The Engine Room Telegraph." It was an ingenious mechanical contrivance for keeping a record of the signals sent down to the engine-room from the bridge. With the telegraph pointed between "Stand by" and "Finished with Engines" and the valve gear at mid-position the circuit is open; move the telegraph into ahead position, put the engines in ahead gear, it still remains open; but should a mistake be made and the engines be put in astern gear, the circuit will be closed, the bell will ring and continue until the mistake is rectified. Mr. Shearer said it would be a distinct improvement on the ordinary engine-room telegraph if gongs or bells of different tones were used to signal ahead or astern. A double bell for astern would be better still. The chairman said a different-toned bell for going astern was already fitted in some ships. Mr. Hulme pointed out that with some engines, especially with compound types, it was sometimes necessary to move the engines in the opposite direction to that ordered. It occasionally happened that when the engines were ordered "ahead," they could not be moved in that direction until after a turn had been made astern. In that event this indicator would represent that a mistake had been made, whereas in point of fact the movement first made by the engine was absolutely unavoidable. Mr. F. T. Aukland proposed a cordial vote of thanks to Sir John Durston, and this was carried unanimously.

At the meeting of the institute on December 11th Mr. T. F. Aukland presided. After a few remarks being made by several members on the question of propellers, a paper was read by Mr. G. Halliday on the "Effect of circulation on evaporation in water-tube boilers." It was due to the kindness of the Editor of this journal supplying certain apparatus which enabled these experiments to be made on the institute premises. Former experiments were made to see whether molecular change in the water was the cause of the increased absorption of heat by water at the boiling point. It was found that at the boiling point there was rather less absorption of heat than at lower temperatures. This was the condition of things when the effects of more rapid motion of the water were eliminated. It was found also that the absorption of heat was at a maximum at a certain velocity and that this particular velocity depended on the quantity of heat supplied to the outside of the tube. In these last experiments it was sought to make the condition of the water as near to that which exists in an ordinary steam boiler as possible. Water when evaporating steam does not run through the tube as water, but as water and steam, and therefore the effect of the pressure of steam may change entirely the conditions. Heat was applied in different quantities to the tube whilst water moved through it at different speeds, and the quantity of steam evaporated noted under the different conditions. It may be premised that the accepted view is that the evaporation increases with the rapidity of circulation of water through the tubes. In the experiments described water was heated up to boiling point in a tank and drawn thence through a tube heated with a Fletcher burner. The steam and water as they issued from the tube were separated in a separator and separately measured. First the flame of the Fletcher burner was kept constant and the rate at which the water moved through the tube was varied. It was sought to determine whether the amount of evaporation remained constant with the heat supplied or varied with the velocity of the fluid through the tube. First, then, the tank supplying the water was heated to boiling point and it gave off steam freely. Then the Fletcher burner was lit and the flames allowed to play on the copper tube. Then the water from the tank was turned on and allowed to run. After the water had gone through the heated part of the tube, steam and water together flowed through the separator into a flask. After that the cold water was turned on at the cold-water tank and made to flow through a condenser. By that time the whole apparatus was in full working order. The period settled for each experiment was four minutes. At the end of four minutes the water in the flask was measured and the condensed steam measured also. The sum of the two gave the quantity of water which flowed through the tube for four minutes. After the first four minutes 14 cubic centimetres of water were found in the measure. This meant that 14 cubic centimetres of water had been evaporated during the same time that 175 cubic centimetres of water had flowed through the tube without being evaporated. The total water which had flowed through the tube was then 189 cubic centimetres. Here are two sets of results.

Velocity of Water.	Water evaporated.	Velocity of Water.	Water evaporated.
93½ ..	23½	54½ ..	24½
94 ..	24	93 ..	23
103 ..	23	122 ..	22
121½ ..	21½	378 ..	18
129 ..	19	575 ..	15
158 ..	18	664 ..	14
189 ..	14	762 ..	12

It will not be assumed that the figures given above show anything but comparative results. A number of factors are purposely left out of consideration, but it may be assumed that the figures show there is not an advantage in a high rate of circulation of water through the tubes of a water-tube boiler. Alderman Kidd, in the discussion which followed, said one of the tables showed that when 76 cubic centimetres of water were flowing, 40 centimetres were evaporated, and when 1,091 centimetres, only 11½ centimetres were evaporated. How did the author account for that? Mr. Halliday said the numbers were simply a matter of observation. Alderman Kidd said the experiment did not represent what went on inside a steamer's boiler, because in the boiler there was no pressure behind the water to force circulation. Mr. Halliday said his paper only dealt with one particular point, and the effect of the results of the experiments was to advise people to so construct water-tube boilers that the circulation through the tubes would be slow and not fast. Mr. Lawrie questioned the value of the experiments carried out by the author as applicable to boilers, because under no conditions that he knew of on board ship was the water heated in the same manner as that adopted by Mr. Halliday. It would be seen from the diagram that there was a considerable head of water to assist the circulation. Mr. Halliday said the difficulty with an ordinary boiler was that they could not control the circulation. They increased the circulation in an ordinary boiler by increasing the quantity of heat supplied, but he wanted to vary the circulation with the same fire, in order to observe the effect of speed of circulation upon the evaporation. An ordinary boiler would not suit the purpose.

The chairman (Mr. Auckland), referring to a suggestion made in the course of the discussion, that further apparatus should be provided for experimental purposes, said he should be happy to subscribe towards the cost, because he thought that experiments of the kind would be very valuable, and that it was for the benefit of the engineering profession that they should be continued and even extended.

The offer of Mr. Auckland to assist financially with the experimental work of the institute is of considerable importance to the advancement of engineering generally. This has been followed by a similar promise by Mr. Laurie, superintendent engineer of the New Palace Steamers. No doubt these will be followed by one or two other gentlemen who have the interests of the profession at heart, and the experimental work will then be placed on a proper foundation.

Messrs. Turner Brothers, Limited, of Spotland, Rochdale, have converted their business into a private limited company bearing the above name, the object of the conversion being to secure the many advantages incident to incorporation. The business will be carried on as heretofore without any change in the management.

DRAKE'S CYLINDRICAL MARINE WATER-TUBE BOILER.

IN the adjoining diagrams we illustrate some modifications in the construction of steam boilers which have been designed by L. H. Drake & Son, M.I N.A., of 157, Fenchurch Street, London, E.C.

The objects sought in these designs have been the provision of greater strength to the internal parts, greater heating surface, better combustion, more efficient circulation of the water, and the reduction of the quantity of water in the boiler.

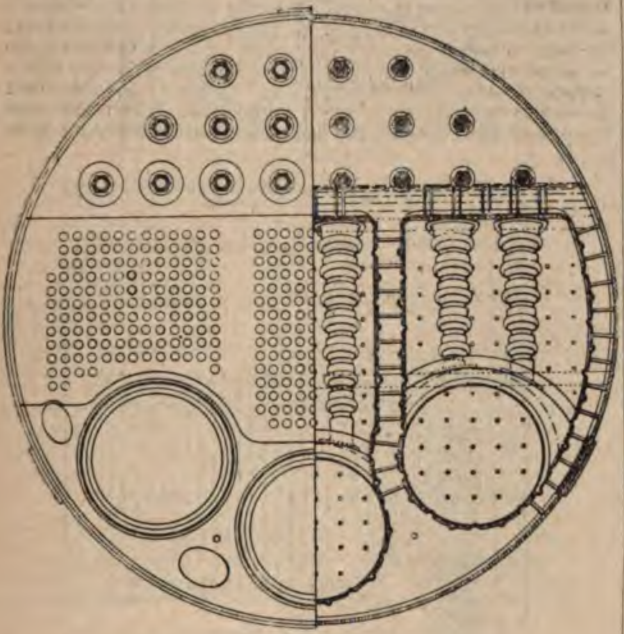


FIG. 1.

Referring to Figs. 1 and 2 of the diagrams, which represent sectional views of a boiler with fire-tubes, it will be noticed that the saddle-plates and combustion-chamber are returned over the crowns of the furnaces for such a distance as to allow of diagonal water-tubes being fitted between the saddle-plates and the crown of the combustion-chambers. The crown and back plates of the combustion-chamber are corrugated to stiffen them; and, although the fire-tubes are somewhat shortened, the water spaces are not materially contracted, and the heating surface, if anything, is somewhat increased.

Referring now to Figs. 3 and 4, we come to another modification, in which the same arrangement of diagonal water-tubes is provided; but the longitudinal fire-tubes are dispensed with, and water-tube boxes are fitted between the combustion-chambers and the front end of the boiler, with vertical water-tubes fitted therein.

It will be also noted that a number of small water-tubes are arranged in each combustion-chamber leading from the bottom water space of the boiler to the upper water space, so as to afford additional heating surface and means of circulation.

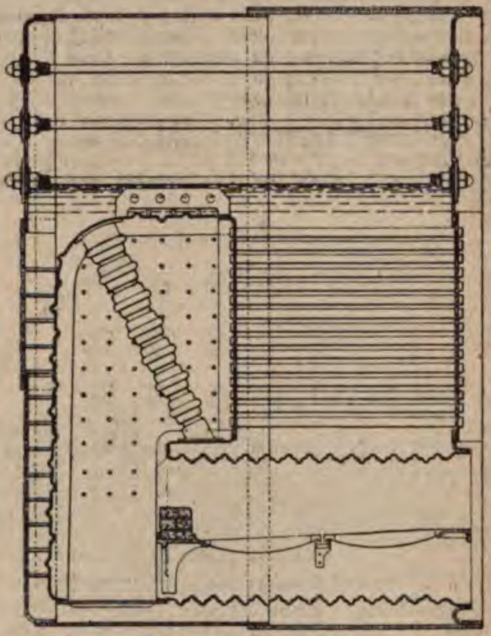


FIG. 2.

We give hereunder a table showing the comparative figures with reference to various classes of boilers in relation to Drake's type. The particulars of the boilers of the four vessels were given in a paper "On the boiler arrangement of certain recent cruisers," read by Mr. Marshall before the Institution of Naval Architects on July 19th, 1889.

Ship	Andromeda	Hermes	Don Carlos	Hai Chi	
Class and No. of Boilers.	30 Belleville	18 Belleville	12 Yarrow	8 Cylindrical 4 D.E. 4 S.E.	Drake 7 S.E.
Total heating surface in sq. ft.	40,500	24,050	32,004	27,558	30,359
Total grate surface in sq. ft.	1,439	750	587	940	378
Total weight in Tons.	559	342	217	447	245
Total weight of Water in Tons.	43	30	30	197	84
Total weight of Boiler and Water in Tons.	602	372	247	644	329

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

Help for the Widows and Orphans.

THE conference at the Mansion House, convoked by the Lord Mayor, to consider the distribution of money subscribed by the public in connection with the war had a very satisfactory result. No soldier's or sailor's widow is to receive less than 5s. a week, and in all probability a much higher rate of pension will be paid. The Lord Mayor handed over the sum of £257,364 for this purpose to the Patriotic Commissioners, and Earl Nelson, who represented the body at the meeting, remarked that the commissioners were quite willing to work in harmony with the custodians of other funds. The old policy of hoarding up money has apparently been abandoned. Over £30,000 of the Mansion House Fund is to be set aside for the sick and wounded, and £38,150 to increase the Government awards to men who lose limbs in the war. The Soldiers' and Sailors' Families Association is to have the handling of nearly £60,000. The Naval Brigade has, up to the present, a larger proportion of killed and wounded than the sister service, and, therefore, sums of money have been collected on board some of the battleships of the Channel Squadron. The *Jupiter*, for instance, contributed £92. Miss Agnes Weston has also collected money for the purpose of sending out to every member of the Naval Brigade a suitable Christmas present. Our seamen at the front are being by no means forgotten, and they certainly deserve some recognition for their work at Ladysmith and Enslin (Graspan).

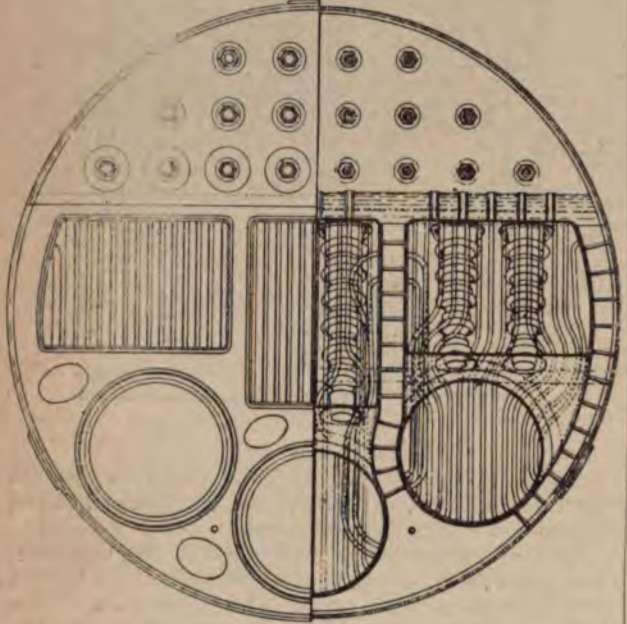


FIG. 3.

Speedy Torpedo Boats.

The speed—and of course the efficiency—of torpedo-boat destroyers is at present receiving considerable attention at the Admiralty. Oil fuel has been up to the present a failure, and therefore attention is once more directed to turbine-propelled boats, such as were first seen at the time of the Diamond Jubilee naval review. The results attained by the *Turbinia* at that time was the instigation of the Admiralty ordering the Parsons Steam Turbine Co., of Wallsend, to commence the construction of the torpedo-boat destroyer *Viper*, which at a recent trial trip was said to have made 37 knots, although this was subequently denied. The trial was made in somewhat boisterous weather, with a heavy sea running, and the result, we are told, surprised those on board. The contract speed for the *Viper* is 35 knots. She has two separate sets of engines on the port and starboard sides, giving four propelling shafts each with two screws. The four shafts are so arranged that the two outer drive the destroyer at 10,000 H.P., whilst the two inner shafts, supplied with one low-pressure motor and one small reversing turbine motor on each side, can take the vessel astern at a rate of 16 knots. Thirty-five knots is a great speed, but in the opinion of the inventor of the turbine, the Hon. Charles Parsons, it is possible to reach 44 knots in a special unarmoured cruiser—a magnified torpedo-boat destroyer of light build, but equipped with an armament of light guns and torpedoes.

The Value of the Fleet in Regard to the War.

A very good story is to hand about one of the troopships which recently left this country for South Africa going out of her course, and steaming at night with all lights out, as it was supposed that one of the vessels hired by the Transvaal Government to waylay our troopships was known to be on the look-out for her. There is probably very little truth in the story, for no suspicious vessel would have been allowed to leave a South African or other port without the knowledge of her departure coming to the ears of the naval authorities. The reason our troopships have crossed the ocean without molestation is in some degree due to the sharp look-out kept by the British Fleet for hostile vessels such as it was reported at the outbreak of war were being purchased by the Transvaal Government. The immense body of troops we are now sending across the sea would possibly be in some danger before they reached their destination were it not for the latent strength of the fleet. This fact was pointed out with characteristic pithiness by Mr. Rudyard Kipling, at a lecture given by a Mr. Wyatt, on behalf of the Navy League at Rottingdean. "In this maritime village," said Mr. Kipling, "there are a few things about Her Majesty's Navy we do not know. We sit on the beach and see occasionally a cloud of smoke in the distance, and the coastguard says, 'It is a man-of-war;' and we say, 'Yes, it is a man-of-war.' But it never occurs to us what it means unless we sit on the beach and think very hard, that under cover of those few distant puffs of smoke we are sending away a small police detachment of 66,000 men, and other things, mules and horses, and hundreds of tons of stores, to get at some people who have interfered with our ideas of right and wrong at a distance of 6,000 miles away, and that it is only possible to do these things by and through the very insignificant naval force which at present we possess."

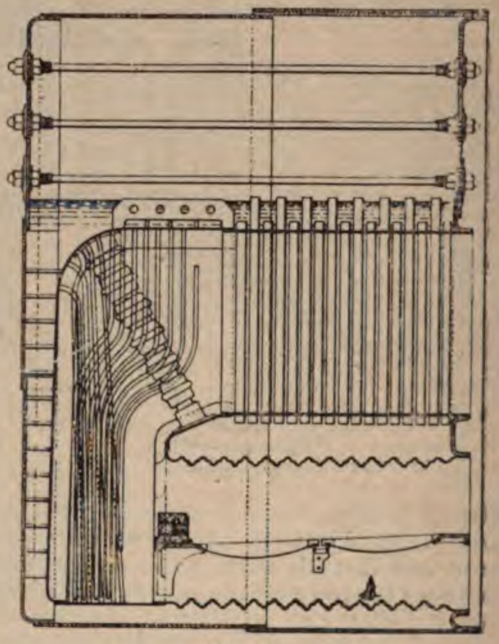


FIG. 4.

The French Navy.

There is considerable agitation at present in French naval circles over the proposal to lay down two new battleships of 15,000 tons each. It is contended that armoured cruisers of 8,000 or 10,000 tons would be more useful for the purpose of destroying English commerce. Admiral Rieunier has avowed his confidence in the battleships, but M. Pelletan considers that in building such large vessels the resources of France would be employed in work which, if war should be declared in four years, would be useless. The French Budget committee at first deferred consideration of the battleships, and then struck them out entirely, two large armoured cruisers being proposed in their place. Finally, however, it was decided not to build the cruisers, and the committee consented to vote the money demanded, provided it was used solely for the purpose of completing vessels already in hand. Considerable opposition to this plan, however, by the advocates of rapid expansion was expected in the Chamber. A large cruiser of 12,416 tons is to be commenced for the French Navy at Cherbourg next year at a cost of about £1,170,000, with a length of 474 ft. and a beam of 71 ft. Her armament will consist of four guns of 7·6 in., sixteen of 6·4 in., twenty of 1·8 in., four of 1·4 in., and five torpedo tubes, two to be submerged. Engines of 24,000 I.H.P., speed 21 knots, effective range 10,000 miles at ten knots.

Portsmouth Dockyard.

Nothing of importance has happened at this yard during the past month. A few weeks ago there was a fire at the coaling station, but happily no serious damage was done. A few hundred tons of coal was partly spoilt, but the dockyard firemen got the upper hand of the outbreak long before there was any danger of the entire stack disappearing in a blaze. This is the second affair of this kind within a month, and the only remedy seems to be a more suitable depot fitted up with electric light. The stack of coal here contains from 8,000 to 10,000 tons, and is as high as a threee story house. Fairly good progress is being made with the *Formidable* and *London*, and the *Pandora* now and then has a proper proportion of workmen on her. The commissioning of the *Canopus* leaves only two battleships in hand—those just mentioned. The armoured cruiser *Kent* has not yet been officially laid down, but a good deal of material has been collected ready to be built into her when this takes place. The armour for the *London* does not come in quite as fast as could be wished, but the barbette armour has nearly all arrived and is being rapidly placed in position, There is, however, a sufficiency of work for all concerned, and the wages bill continues to amount to more than £12,000, and has been as high as £14,000.

The Austrian Navy.

Austria is at present in the throes of a naval "scare," owing to the neglect from which it is said her Navy is suffering, and apparently what is wanted is an Austrian Navy League to impress upon the people and Government the necessity for a stronger navy than that country at present possesses. The Naval Budget which has just been presented to the Delegations provides for the building of an armoured cruiser of 7,000 tons to replace the old *Radetzky*, for the completion of the torpedo cruiser *Zenta*, and for continuing work upon two other vessels of the same class. In addition to these charges, which are upon the ordinary estimates, there is an extraordinary charge which provides for the building of a battleship of 8,340 tons, to replace the *Erzherzog Albrecht* to cost 11,000 crowns. Work upon vessels in hand is, of course, to be carried forward, and provision is made for this and also for their armament when completed. Count Goluchowski addressed the Delegations, and in the course of his speeches pointed out that the fleet as it exists at present is absolutely incapable of dealing with any foreign complication. He said that, although Austria does not contemplate creating a fleet of the first rank, it is not desirable that she should be less than a third-rate Naval Power. The *Armee Blatt* in a despondent article upon the situation, says, that the Austrian fleet, comparatively speaking, is weaker now than when the battle of Lisa was fought, and points to the downfall of the Spanish Empire as the result of the neglect of its navy by a great Power. During the month, Sir John Fisher entertained the officers of the Austrian squadron at dinner and a series of entertainments was arranged.

The Queen and the Navy League.

The Navy League is to be congratulated upon obtaining the Queen as a life member of their association, and it is admitted, as might be expected, that this is a source of considerable satisfaction to the members of the executive committee. Her Majesty graciously sent a donation of £10 to the funds of the Windsor and Eton branch of the league, in response to a letter of the hon. secretary of the Windsor branch of the organisation on the subject of the training vessel for boys which has been established. The donation came through Sir Fleetwood Edwards, accompanied by a letter expressing her Majesty's good wishes towards the league, and acknowledging the work done by it in the course of the past few years. There is no doubt that the Navy League has done a great deal of excellent work, and it is to be congratulated on its present policy, which is an extremely modified one when compared with the energetic, but sometimes rash, advocacy of proper care for the naval defences of the country displayed in earlier days.

Devonport Dockard.

A start has been made with the building of the new first-class battleship *Montagu*, which has now been in hand over a month. It was thought at first that there was little prospect of the keel of the *Montagu* being laid before this month, but material arrived in large quantities, and it was thought advisable to make a start as early as possible. The bracket frame and longitudinals were got in position a week after the keel plates were laid, and altogether work may be said to be proceeding apace. Overtime has practically ceased. No instructions have been given about the refit of the ships of the Channel Squadron, which are to spend Christmas at this yard, and probably only absolutely necessary repairs will be taken in hand. In view of this work it is impossible to say when work will be commenced on the *Anson*, which has been relieved by the *Canopus* in the Mediterranean. In any case her refit will not be completed for some months. There was a small outbreak of fire in the ropery during the past month, but it was discovered before the flames had made much headway, and the machinery only needed cleaning to once again set it in action. The enquiry into the loss of the 11,000 gallons of olive oil from this yard has resulted in the loss being put down to natural wastage. The blame had been placed at the door of Mr. T. Wills, but that gentleman died at the commencement of last month without knowing that he had been absolved from blame. The new cruiser *Highflyer* is to take the place of the *Eclipse* as flagship of the East Indies Station. She is a distinct improvement upon the present flagship of Rear-Admiral Bosanquet, as she has a superior armament, and is fitted with Belleville boilers.

The Naval Brigade in South Africa.

Her Majesty, as usual, has been prompt in recognising the services of those who are fighting for her in South Africa. No sooner did she hear of the bravery of the Naval Brigade at Enslin than she dispatched the following telegram to Sir Robert Harris: "The Queen desires that you will convey to the Naval Brigade who were present at the action at Graspan her Majesty's congratulations on their gallant conduct, and at the same time express the Queen's regret at the losses sustained by the brigade." The casualties at this and other fights have been heavy, both officers and men being killed and wounded in great numbers. Company after company of men have been landed from the vessels constituting the Cape Squadron, and have been sent with their guns to assist Lord Methuen on the western border, Sir Redvers Buller on the Tugela, and to assist in the defence of Durban. At the latter place the seamen are working an armoured train and altogether proving of great assistance. The point has been raised in the *Times* as to whether it is desirable that the *personnel* of the Navy should be drained away in military operations hundreds of miles from the sea; and whether, when such brigades are landed, they should not be under the command of an officer of the Royal Marines. These are dull times for the Navy as regards fighting, and therefore the consensus of opinion from naval officers is that naval brigades should certainly be landed where necessary, whether the men are commanded by officers of the Royal Navy or Royal Marines.

Canadian Nickel Steel for British Warships.

The favour with which nickel steel, as a material for armour plates, is now looked upon by the officials at Whitehall has once more raised the hope that they may be induced to reopen negotiations with the Government of Ontario for opening up the still unpatented nickel lands of the province, and to assist in their development for the purpose of obtaining an unlimited supply of nickel for use in the construction of British warships. In 1891 it appears that the Government of Ontario made an offer to the Admiralty with this end in view, but, as the Whitehall authorities did not have as much belief in the value of nickel steel as they have nowadays, the negotiations fell through. The Commissioner of Crown Lands at that time wrote to the Home Government about the extent of the deposits, and added that as a colony of Great Britain, and as a portion of the British Empire, Ontario was concerned in all things which contributed to the greatness and stability of the parent State; and, recognising especially how much depended on the maintenance of her historic position as a naval Power, it would be agreeable to the Canadian people that the legislature should further, in any way consistent with its obligations to the province, the means whereby that position may be most effectually safeguarded and preserved. The Home Government is once more to be communicated with, and in view of the growing importance of nickel steel in naval construction, the Admiralty may be induced to favourably consider the suggestion made. The value of nickel steel for armour plates has been tested in France and Germany, and plates made of this material rendered good service to American warships when recently engaged with the fleets of Spain.

Chatham Dockyard.

A start has not yet been made officially upon the new battleship *Albemarle*, but material for her construction is being prepared, and the keel is being temporarily put together in No. 7 slip. Her engines are to be built by the Thames Ironworks Co. and will be of the inverted vertical, three-cylinder triple-expansion type, developing 18,000 I.H.P. Steam will be supplied by 20 boilers of the Belleville water-tube type, and that it is expected that a speed of about 19 knots will be obtained under natural draught. The engines for the battleship *Venerable*, which is now completing, have not yet been delivered from Messrs. Maudsley. The *Goliath* was to have been out of hand by the end of December, but some little delay was occasioned by the late delivery of her gun shields. She has creditably passed all her engine trials, and as soon as possible is to replace the *Centurion* as flagship on the China Station. The cruiser *Pyramus* and the destroyer *Zebra* have both been placed in the Fleet Reserve, and are now ready for sea. The *Pyramus* passed through all her machinery and gunnery trials in a highly satisfactory manner, but the *Zebra*, which was delivered here nearly two years ago, has only just passed out of the dockyard hands. Of the vessels under refit here, the *Imperieuse* and *Immortalite* are being expedited as much as possible, and the old composite corvette *Tourmaline* is being converted into a coal hulk at a cost of about £6,000. The whole of the armament of the *Irresistible* has now been received, but there was not much hope, when the armour did not come in as it was expected to, that the trials would be carried out before Christmas.

The Russian Navy.

There is considerable activity at present in Russian naval shipbuilding circles, caused principally by the published intention of the Government to vigorously pursue the policy of expanding the Navy as rapidly as possible. The estimates for 1900-1 amount to a sum of 88,000 roubles, which is more than half-a-million above the expenditure for the 12 months just completed. The actual sum, however, spent upon new construction will probably be less than that spent this year, as a good deal of the money asked for will be expended upon the defences of Port Arthur and Vladivostock. It is proposed also to increase the *personnel* of the Russian Navy—at present supposed to number 41,000 officers and men—to 52,250, but it remains to be seen whether so large an addition of trained officers and men can be made to the fleet of any country in 12 months. The recently published estimates state that the construction is to be commenced of a special vessel for surveys in the Arctic regions, and a "transport" of 10,000 tons for machinists, probably a vessel of the same class as the *Vulcan*. One battleship, the *Tchesure*, is to be adapted for the consumption of liquid fuel, and several vessels now in various stages of completion are to undergo their steam-trials and hoist the pennant. Considerable additions are to be made to the Russian forces in the Far East, including the *Petropavlovsk*, and possibly another battleship, a cruiser, a gunboat, and a number of torpedo boat destroyers. The Pacific Squadron is also to be reinforced. However, there is no need for Great Britain to unduly concern herself over these proposed increases in the Russian Navy, as it will probably be several years before they are completed, especially that relating to the *personnel*.

Mechanical Stokers.

Some interesting experiments have recently been conducted by the United States Naval Department with mechanical stokers in vessels fitted with the water-tube boiler; and, although these were the first trials made in that country, the results have been, on the whole, very promising. A large steamer of 10,000 tons' displacement, fitted with Babcock & Wilcox water-tube boilers, supplying steam of about 250 lbs. pressure to quadruple-expansion engines of about 1,600 I.H.P., was fitted with the mechanical stokers, three to each boiler. The boilers have 6,000 square feet of heating surface and 65 square feet of grate, the weight being 65 tons, excluding water, which weighs 15 tons. Small coal thrown into a hopper is continually fed by a conveyer or screw into a central magazine, and in this it is gradually forced upwards, overflowing into tuyere blocks, through which air is supplied by a blower. The coal is gradually heated as it is forced up in the magazine, and thus the volatile gases are released, and are burned by the air issuing from the inside of the tuyere blocks. A sort of coke is, at the same time, furnished to the dead grates at the side of the stoker, and the air for the combustion of this is supplied by the openings on the outside of the tuyere blocks. At the side of each stoker is a door for cleaning the grate, &c., and this could be utilised for ordinary stoking if the mechanism went wrong. No air is admitted except through the tuyeres. The weight of each stoker complete is 3,500 lbs. Inferior coal was used—a cheap grade of slack—but the caloric value is not stated. The steam and water was measured for both main and auxiliary engines, and it was found that the six stokers used 138·6 lbs. of steam per hour, equal to 4·29 per cent. of the total steam generated; but when the blower-exhaust was passed through the heater the cost was only 1·68 per cent of the total. The stoker worked satisfactory in all tests.

Sheerness Dockyard.

The passing of the *Perseus* into the A Division of the Fleet Reserve has brought to an end her long connection with this yard. She was commenced in May, 1896, and has therefore been in hand over three and a-half years. Another ship which has finished her connection with this port is the *Sheldrake*, which in future will have all her defects made good at Portsmouth. She has now entered upon her duties in Scotland. Some interesting experimental trials have recently been carried out with the gunboat *Skipjack*, and, on the whole, these tests have been uniformly successful. She was to have the blades of her propellers reduced in size, and was then to run another trial. The finishing of the cruisers *Perseus* and *Prometheus* caused a good deal of overtime to be worked, especially in the electrical department. The first-named vessel has undergone a trial of her electrical fittings, but there is apparently no present intention of commissioning her, and she is to go to Chatham when completed to await orders. The *Prometheus* is to be passed into the Fleet Reserve by the middle of this month. The *Niger*, which is now lying in the harbour here, will probably be fitted with new engines and boilers, and if this takes place, she will be a much more useful and valuable vessel than at present.

The Launch of the "Cressy."

The launch of the first-class cruiser *Cressy* took place at Govan, from the yard of the Fairfield Shipbuilding Co., last month. She is in many respects an improvement upon the *Diadem* and *Argonaut* type of cruiser built at the same yard, both as regards offensive and defensive power. Dr. Elgar, the managing director of the company, at a lunch following the launch, said in the course of a speech that the *Cressy* is over 5 ft. longer than her predecessors and has 6 in. more beam, but she can be loaded over a foot deeper and has an additional 1,000 tons displacement. This increased displacement has enabled important improvements to be made in those fighting qualities which distinguish the *Cressy* class from their predecessors. The engine power has been increased, and it is expected that the new cruiser will be half a knot faster than the *Diadem*. The additional displacement has also enabled a material addition to be made to the defensive power of the ship, the whole of that portion of the ship containing the fighting power being protected by a central citadel. Mr. W. Main, one of the constructors of the Admiralty, said he had never seen a better launch. The present vessel is the third to bear the name of *Cressy* during the present century. The first was built on the Medway in 1810, at a time when we were glad to build ships anywhere. She was followed in 1853 by an 80-gun ship, built at Chatham. This vessel was originally designed as a sailing ship, but before launching was fitted with a small auxiliary engine, which gave her speed of seven knots or less, and that was practically the description of the ships in her Majesty's

Navy when he first joined it. The present *Cressy* is, of course, a vast improvement on these ships, and will prove a credit to her designer, Sir William White.

Naval Gunnery.

There is little, if any, material improvement in the gunnery of the Royal Navy over the practice made during 1897, if the annual prize-firing return dealing with the year 1898 may be taken as a criterion. Some of the ships have made very good scores indeed, but others deserve censure for their very bad records. The averages obtained with the 13·5 and 16·25-in. guns are good, and speak well for the smartness of the guns' crews. Sixteen battleships between them fired 307 rounds from these guns, and the *Rodney* headed the list with 69 per cent. of hits, a record which probably cannot be approached by the gunners of any other navy. The *Sans Pareil*, for some reason at present unknown, only fired six shots, not one of which hit the target. With the 12-in. gun the average percentage of hits was 29·1. The *Victorious* scored 52 per cent. of hits, whilst the *Prince George* only made 13 per cent. The *Collingwood* and *Colossus* are armed with 12-in. guns, but of another pattern to those of the *Victorious* and *Prince George*, and between them made an average of 32·4, the *Colossus* scoring 43 per cent. of hits, against 19 per cent. of the *Collingwood*. The shooting with the 9-in. and 8·2 guns resulted in a percentage of 43·6, the *Powerful* heading the list with 70 per cent. The average percentage of hits with the 6-in quick-firing guns was 28, and with the smaller quick-firing guns a fair record was obtained. It is suggested that in order to induce gunnery officers to work for good markmanship, an improved system of rewards and punishments should be adopted, the rewards at present being insufficient, and the punishment for bad shooting nil.

Pembroke Dockyard.

The new Royal yacht building at this yard is to be undocked, according to present arrangements, on the 3rd of this month and to undergo her preliminary steam trials on the 5th and 6th. On the 8th she is to leave for Portsmouth, there to be completed for service. Some doubt, however, has been entertained about this programme being carried out, as it was uncertain whether the alterations to be made with the object of improving her stability could be carried out in time. Her engines and boilers have satisfactorily undergone the official water test, and the result shows that great credit is due to Messrs. Humphrey & Tennant, who have built the engines and boilers in the ship. Several alterations have been made in various parts of the vessel, as, for instance, the construction of a separate chamber for the stowage of the distilling apparatus, the shortening of the masts, and the removal of a number of large ventilating cowls from the upper deck. Two new funnels are to be supplied to the vessel at Portsmouth. If all the alterations now under consideration by the Admiralty are carried out by this yard, the *Victoria and Albert* will remain at this yard for another four months. The keel of the ***Essex*** has not yet been formally laid down and no date has been given as to when this will take place. Good progress is being made on the *Spartiate*, and the bill for labour on her each week amounts to about £900.

ELECTRICAL NOTES.

(From our own Correspondent.)

Space Telegraphy.—It is unfortunate that no apparatus for telegraphing through space without wires was taken with the beleaguered forces at Kimberley and Ladysmith. Since the relieving forces have got quite close to the forces in Ladysmith and Kimberley, it does not matter so much, but before that time the want of a means of communication was extremely awkward. Marconi's system has been introduced to the British Navy as a branch study. The *Hector*, lying at Portsmouth, has been fitted out as a school of instruction, and signalmen from her are to be attached to the battleship *Canopus*, which went to the Mediterranean last month, taking Marconi instruments as part of her equipment.

Ferry Boat Run by Storage Batteries.—The Electric Boat Co. intend as a start to build a heavy ferry-boat which will be worked by a storage battery, and the experiment will be made around Philadelphia. Should the experimental stages pass off all right, the company will make a feature of the line. It is the intention of the company to organise a number of smal companies for operating launches and boats at several summer resorts and watering places.

"Holland" Submarine Boat.—This boat, which is worked electrically, has been reported on by the Inspection and Survey Board (U.S.A.), and the report states the trials were successful. Chief Engineer John Lowe was specially ordered to witness all trials; his report commends the *Holland*. He says:—"I report my belief that the *Holland* is a successful and veritable submarine torpedo-boat, capable of making a veritable attack upon the enemy unseen and undetectable, and that therefore she is an engine of warfare of terrible potency, which the Government must necessarily adopt into its service." He adds "that this Government should at once purchase the *Holland* and not let the secrets of the invention get out of the United States." This also is rich, and very American:—"We need, right off and right now, 50 submarine torpedo vessels in Long Island to protect New York, preserve the peace, and to give potency to our diplomacy." The *Holland* is now round at Washington giving an exhibition in the Potomac river, for the benefit of the Congress and Navy Department officials.

Electrical Plant of the Battleships "Kearsarge" and "Kentucky."—A paper has been read before the Society of Naval Architects and Marine Engineers of New York. The author says "All current for power and light is supplied through three main distribution boards on the splinter deck, No. 1 forward, No. 2 amidships, No. 3 aft. Each of these main distribution boards is supplied by an independent set of feeders, which run directly to the bushes of the main switchboard. Each of the feeders consists of five wires, over which is the neutral for both light and power, two of the others being the positive and the negative for the power, and the remaining two positive and negative for the lights. The reason for thus dividing the feeders is to prevent variable loads on the power system from affecting the steadiness of the lights; but, as the neutral carries but a small current the effect of having this common is inappreciable. The turret-turning motors are fed through the board amidships, No. 2, by separate feeders from the generator board. The lights are fed from these boards upon two-wire feeders and mains, and the switches controlling these individual circuits are distributed upon each side of the method, so as to give as nearly a balanced load as possible. The power is supplied either directly to the motors or through auxiliary boards located in the turrets and upon the main and berth decks. Motors for the turret-turning, exhaust fans, rammers, and elevators are run on 80 volts, and all the others are worked at 160 volts, but a switch is provided by which either 160 or 80 volts may be supplied with the corresponding difference in speed. Distribution board No. 1 is upon the splinter deck near the outer wing bulkhead, and feeds four systems of distribution. These are: (1) Incandescent lights. (2) Searchlights. (3) Communication signals. (4) Power. In 1, incandescent lights are for battle lighting circuit, for the forward turrets and handling rooms; battle circuit for the light in the chart-house, conning tower, running lights, and signal lights on both masts; also new battle circuit for lights under the fore and aft bridge; battle lighting circuit in the forward magazine and shell rooms; battle and lighting circuits supplying all lights on the protection and berth decks. In 4, power is supplied to exhaust blower in the crew's water closet; 5-in. ammunition hoist starboard on the platform deck; ventilating fans in the forward blower room; boat cranes and deck winches on the superstructure deck; all the power in the forward 8-in. and 13-in. turrets, except that of the turning motors. Wherever possible the mains have been subdivided, so that only small sections shall be dependent upon one fuse, which will open the circuit in case of trouble without disturbing the other lights supplied by the same feeder. Wherever wire enters the masts above the main deck, flexible couplings, consisting of heavy rubber hose, are inserted in the conduit in order to allow the mast to move relative to the deck without injuring the protection of the wire. There are five different kinds of controllers used in these ships, divided into three classes. The first are rheostatic in their method of operation, and are used for the purpose of starting, stopping, reversing, and controlling the speed of the motors. They are particularly designed to carry a load in either direction. The second are those which are designed to give electrical working. The third is used where the voltage of the generator is to be varied, in order to obtain a change of speed of the motor, and is, therefore, called a variable-voltage-controller. The engine of the main generating sets is of the single-crank vertical tandem compound double-acting enclosed type, and has a speed of 310 revolutions per minute at full load, with 100 lbs. steam-pressure and 25 in. vacuum. There is a heavy bed-plate bolted to the foundation supporting the engine and generator, and part of this bed-plate forms a reservoir for the oil used for lubrication. The crank-pit is accessible through a large door in front of the engine and a smaller one at the back. The normal and most economical steam-pressure is 100 lbs., but the engine will carry an overload of 50 per cent., and may be run on a steam-pressure up to 150 lbs. without any trouble. The cylinders are $10\frac{1}{2}$ in. and 18 in. diameter, and stroke 8 in. The cylinders are cast in one piece, with the low-pressure cylinder on top. Both cylinders have relief valves, and are tapped for drain and indicator valves. The clearance in the high-pressure cylinder is $7\frac{1}{2}$ per cent., and in the low-pressure cylinder $7\frac{1}{4}$ per cent. The shaft and crank are made from one solid piece of steel. Cast-iron counter-balanced weights are fastened to the crank opposite the crank-pit. A small eccentric, with $\frac{5}{8}$ in. stroke, is turned on the hub of the coupling for driving the oil-pump. The main bearings, two in number, are hollow cylindrical cast-iron shells, with flanges for bolting to the standard. The governor consists of a heavy fly-wheel keyed to the shaft, and carrying the governor parts and the high-pressure eccentric. The governing mechanism consists of a single fly-weight connected to a lever carrying the pin which operates the high-pressure valve. The motion of the fly-weight is opposed by a spring attached to the pulley. By decreasing or increasing the tension on this spring the speed may be lowered or raised. The lubricant is forced under pressure to the various bearings. The generators are compound-wound for 80 volts of the multipolar type, having six poles and an output of 50 kilowatts, with an armature speed of 310 revolutions. Each generator is secured to a cast-iron base, to which also is fastened the compound engine. The magnet frame is a cast-steel ring made in two pieces, which are held in position by keys. There are two 50-H.P. electric motors below the floor of each 13-in. turret. These motors are regulated and controlled in speed and direction by a controller situated under the sighting hood between the 13-in. guns. The operator has only to turn his controller-handle from the 'off' position in the direction in which he wishes the turret to move, and the motors will drive the turret as desired, the speed of travel depending on the amount which the handle has been displaced. The fields of the motors of the generator are separately excited from the switch-board lusbars, and are consequently independent of the voltage generated by the armature of the dynamo. The field rheostat on the generator-board is cut out, and in its place another rheostat in the turret operated by the controller is used, the generator field-wires being carried to the turret for this purpose. The series coil of the generator is shut, circuited by a switch over the head-board."

The Royal Navy List Diary and Naval Handbook for 1900. London: Witherby & Co.

This is the third year of publication of this very useful diary, The space afforded is sufficient to be of practical utility, each day having to itself a full octavo page. Space for cash accounts is also given. But the discernment of those who are responsible for the publication is most apparent in the selection of matter in the printed pages which, to the number of seventy, precede the diary. Here we find a calendar; the usual postal information; much information as to Admiralty officials, naval institutions and such-like; details as to officials of various kinds, not directly connected with the service, yet at the same time from their nature likely to be brought into the view of the naval officer; a reprint of the First Lord's statement which accompanied the last naval estimates; and interesting resume of the naval progress of the past year, by L. G. Carr Laughton; an obituary of deceased officers—including in a slip so recent a loss as that of the lamented and gallant Commander Egerton, who fell in the present Boer War—together with a full extract from Lean's "Navy List" of the war and meritorious services of the deceased officers; a table of British medal and various other notes. The selection seems admirable. But at page 56 there is one statement which seems calculated to mislead. In giving an account of the Admiralty Division the editor says "the evidence is all documentary." We think he must be mistaken. Surely we seem to have seen officers and seamen in the witness box in the Admiralty Division giving oral evidence. Perhaps next year this point will be altered, or at least made clear.

Summary of Shipbuilding Returns of United Kingdom in 1899, arranged in order of Tonnage built by each Firm.

No	Name of Firm.	Place.	No. of Ships.	Total Tons.
1	Harland & Wolff, Ltd.	Belfast	7	82,634
2	Wm. Gray & Co., Ltd.	Hartlepool	27	77,501
3	Sir W. G. Armstrong, Whitworth & Co., Ltd.	Tyne	12	57,543
4	Russell & Co.	Clyde	16	52,465
5	Workman, Clark & Co.	Belfast	10	45,018
6	Palmer's Shipbuilding Co.	Tyne	7	42,683
7	C. S. Swan & Hunter	Tyne	7	42,522
8	John Brown & Co., Ltd., Clydebank Shipbuilding and Engineering Works	Clyde	4	41,400
9	Ropner & Son	Tees	12	39,977
10	Furness, Withy & Co., Ltd.	Hartlepool	7	38,095
11	J. L. Thompson & Sons, Ltd.	Wear	9	36,013
12	Sir James Laing & Sons, Ltd.	Wear	7	34,384
13	Richardson, Duck & Co.	Tees	10	34,117
14	Sir Raylton Dixon & Co., Ltd.	Tees	9	34,075
15	Charles Connell & Co.	Clyde	6	33,183
16	Vickers, Son & Maxim, Ltd.	Barrow	6	32,672
17	Fairfield Shipbldg. Co., Ltd.	Clyde	4	31,624
18	Wm. Denny & Bros.	Clyde	11	31,300
19	Short Bros.	Wear	8	30,060
20	Wm. Doxford & Son, Ltd.	Wear	7	29,543
21	Wigham-Richardson & Co.	Tyne	7	28,751
22	Hawthorn, Leslie & Co., Ltd.	Tyne	5	28,574
23	J. Readhead & Sons	Tyne	8	27,133
24	Sunderland Shipbuilding Co.	Wear	5	26,163
25	Wm. Hamilton & Co.	Clyde	7	25,865
26	Irvine's Shipbuilding and Dry Docks Co., Ltd	Hartlepool	6	24,004
27	A. McMillan & Son, Ltd	Clyde	8	21,273
28	Barclay, Curle & Co., Ltd.	Clyde	5	20,976
29	Scott & Co.	Greenock	4	20,544
30	A. Stephen & Sons	Clyde	4	20,530
31	Northumberland Shipbuild'g Co., Ltd.	Tyne	6	20,330
32	John Priestman & Co.	Wear	4	20,240
33	Craig, Taylor & Co.	Tees	9	19,022
34	J. Blumer & Co.	Wear	6	18,005
35	Robert Thompson & Sons	Wear	7	17,650
36	W. Pickersgill & Sons	Wear	6	17,187
37	D. & W. Henderson & Co.	Clyde	4	15,323
38	R. Napier & Sons	Clyde	3	14,700
39	Tyne Iron Shipbdg. Co., Ltd.	Tyne	4	14,545
40	Bartram & Sons	Wear	4	14,529
41	A. Rodger & Co.	Clyde	6	14,501
42	R. Craggs & Sons	Tees	6	14,384
43	Caird & Co., Ltd	Clyde	3	14,036
44	W. Dobson & Co.	Tyne	7	13,262
45	A. & J. Inglis	Clyde	6	13,080
46	R. Stephenson & Co., Ltd.	Tyne	4	12,601
47	Simons & Co., Ltd.	Clyde	13	12,000
48	London and Glasgow Shipbuilding Co.	Clyde	5	11,483
49	S. P. Austin & Son, Ltd.	Wear	6	11,368
50	Wood, Skinner & Co., Ltd	Tyne	8	11,293
51	Blyth Shipbuilding Co., Ltd.	Blyth	5	10,663
52	Gourlay Bros. & Co.	Dundee	8	10,230
53	Earle's Shipbuilding Co., Ltd.	Humber	28	10,170
54	Laird Bros.	Mersey	3	9,634
55	Osbourne, Graham & Co.	Wear	3	9,487
56	R. Duncan & Co.	Clyde	5	9,230
57	Campbeltown Shipbuildg. Co.	Campbeltown	6	9,063
58	Hall, Russell & Co.	Aberdeen	11	8,954
59	Napier & Miller, Ltd.	Clyde	19	8,100
60	T. Turnbull & Sons	Whitby	4	8,006
61	Grangemouth Dockyard Co.	Grangemouth	6	7,689
62	Cochrane & Cooper	Beverley	39	7,453
63	Lobnitz & Co., Ltd.	Renfrew	20	7,062
64	David J. Dunlop & Co.	Clyde	3	6,600
65	Murdoch & Murray	Clyde	8	6,518
66	Ailsa Shipbuilding Co.	Troon	10	6,139
67	Mackie & Thomson	Clyde	18	5,920
68	A. W. Robertson & Co.	Thames	48	5,795
69	Caledon Shipbuilding and Engineering Co. Ltd.	Dundee	4	4,957
70	Smith's Dock Co., Ltd.	Tyne	23	4,432

LIST OF VESSELS LAUNCHED IN 1899.

ENGLISH.

By ALLSUP & Co., LTD., Caledonian Foundry, Strand Road, Preston.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Energy	Steel	Steam	British	20	340
† Toroa	,,	,,	,,	175	500
Florence	,,	Barge	,,	—	—
b Petschora	,,	Steam	Foreign	48	300
By S. P. AUSTIN & SON, LTD., Wear Dockyard, Sunderland.					
† Semantha	Steel	Steam	British	2,847	1,100
† Highgate	,,	,,	,,	1,780	800
† Gregynog	,,	,,	,,	1,699	800
† Sunningdale	,,	,,	,,	1,798	800
† Spero	,,	,,	,,	1,199	650
† Huddersfield	,,	,,	,,	2,045	900
By BARTRAM & SONS, South Dock, Sunderland.					
† Hyanthes	Steel	Steam	British	3,427	2,590
† Ohio	,,	,,	,,	4,005	2,400
† Baron Eldon	,,	,,	,,	3,705	1,890
† Hesperides	,,	,,	,,	3,392	2,590
By COOK, WELTON, & GEMMELL, South Bridge Road, Hull.					
† General Gordon	Iron	Steam	British	212	350
† Boadicea and Cleopatra	,,	,,	,,	193ea	350ea
† Fulmar	,,	,,	,,	312	350
† Newington	,,	,,	,,	193	400
† Viking and Shamrock	,,	,,	,,	180ea	350ea
† Northward Ho	,,	,,	,,	180	340
† Isis	,,	,,	,,	175	350
† Sophron and Isernia	,,	,,	,,	179ea	380ea
† Satyrion, Straton, and Strymon	,,	,,	,,	198ea	380ea
† Horus	,,	,,	,,	173	350
† Jeria	,,	,,	,,	197	380
† Vulture	,,	,,	,,	190	400
† Khartoum	Ir'n & St'el	,,	,,	302	550
† Persian Empire and Grecian Empire	Iron	,,	,,	195ea	400ea
† Hornsea	Ir'n & St'el	,,	,,	310	550
† Mayfly	Iron	,,	,,	191	390
† Tobago	,,	,,	,,	170	300
† Oliver Cromwell and No. 252	,,	,,	,,	225ea	370ea
† Rosalind	,,	,,	,,	200	350
By R. CRAGGS & SONS, Middlesbro' and Stockton-on-Tees.					
† Jokai	Steel	Steam	Foreign	2,737	1,700
† Albatross	,,	,,	British	613	561
† B. Kemeny	,,	,,	Foreign	2,710	1,700
† Dartmeet	,,	,,	British	749	525
† Bernicia	,,	,,	,,	3,355	2,000
† Hercules	,,	,,	,,	4,220	2,000
By CRAIG, TAYLOR & Co., Thornaby-on-Tees.					
† Anna	Steel	Steam	Foreign	2,034	1,200
† Archanda	,,	,,	,,	2,058	1,200
† Ormley	,,	,,	British	4,158	2,275
† North Sea	,,	,,	,,	1,710	1,100
† Etruria	,,	,,	Foreign	1,660	1,350
† Macedonia	,,	,,	,,	1,690	1,350
† Sheffield	,,	,,	British	2,106	1,200
† Osmo	,,	,,	Foreign	1,530	850
† Arechondo	,,	,,	,,	2,076	1,200
By G. NAPIER & SON, Cross House Engineering Works, Southampton.					
Lightship	Steel	—	British	30	—
* Boomerang	,,	Steam	,,	40	15
* Dolphin	,,	,,	,,	85	90
* Carrier	,,	,,	,,	85	90
By LAIRD BROTHERS, Birkenhead.					
† Glory	Steel	Steam	British	a8,000	13,500
* Mabel Grace	,,	,,	,,	1,314	5,500
† Som	,,	,,	Foreign	320	6,000

*Compound. † Triple. b Compound paddle.

By JOHN JONES & SONS, Brunswick Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Nelson and Toxteth	Steel	Steam	British	150ea	650ea
Nos. 1 and 2	,,	Sail	Foreign	60ea	—
Elephante	,,	,,	,,	210	—
Cabrea	,,	,,	,,	80	—
Boto and Zebra	,,	,,	,,	145ea	—
Emu and Mosca	,,	,,	,,	85ea	—
* Problem	,,	Steam	British	150	250
* Waterloo and Brunswick	,,	,,	,,	150ea	650ea
D.C. Nos. 1 to 4	,,	Sail	Foreign	80ea	—
,, ,, 5 and 6	,,	,,	,,	50ea	—
By R. & H. GREEN, LTD., Blackwall.					
* Sirdar	Steel	Steam	British	140	800
* Gladys	,,	,,	,,	70	100
Lightship	Composite	—	,,	—	—
6 Lighters	Steel	—	—	130	—
Iron Pontoon for Waterloo Pier Police Station, London.					
By IRVINE'S SHIPBUILDING AND DRY DOCKS CO., LTD., West Hartlepool.					
† Peareth	Steel	Steam	British	2,838	1,250
† Manchester Importer	,,	,,	,,	5,163	2,000
† Robert Irvine	,,	,,	,,	3,583	1,400
† Clumberhall	,,	,,	,,	3,600	1,400
† Manchester Shipper	,,	,,	,,	5,200	2,000
Vauxhall	,,	,,	,,	3,620	1,400
By THE NORTHUMBERLAND SHIPBUILDING Co., LTD., Northumberland Shipyard, Howdon-on-Tyne.					
† Ravenshoe	Steel	Steam	British	3,592	1,680
† Nordpol	,,	,,	Foreign	3,716	1,680
† Ferndene	,,	,,	British	3,752	1,680
† Newark	,,	,,	,,	1,132	960
† Hillglen	,,	,,	,,	3,838	2,040
† Rosalie	,,	,,	,,	4,300	2,040
By W. H. POTTER & SONS, Wapping Dock, Liverpool.					
† H.M.S. Britomart	Steel	Steam	British	320net	1,300
By J. PRIESTMAN & Co., Southwick, Sunderland.					
† Rhodesia	Steel	Steam	British	3,560	310
† Offa	,,	,,	Foreign	3,250	312
† Granada	,,	,,	,,	6,715	436
† SS. No. 81	,,	,,	,,	6,715	436
By G. RENNIE & Co., Thames Street, Greenwich.					
Vigilant	Steel	Steam	—	130	350
Sirdar	,,	,,	—	Tons displacement. 75	120
6 Lighters	,,	—	—	265e	—
5 ,,	,,	—	—	205e	—
6 ,,	,,	—	—	190e	—
4 ,,	,,	—	—	180e	—
4 ,,	,,	—	—	175e	—
5 ,,	,,	—	—	170e	—
3 ,,	,,	—	—	150e	—
16 ,,	,,	—	—	140e	—
1 ,,	,,	—	—	120	—
7 ,,	,,	—	—	80e	—
1 ,,	,,	—	—	70	—
By R. WILLIAMSON & SON, Workington, Cumberland.					
* Fred	Steel	Steam	British	312	390
* Formby	,,	,,	,,	430	560
† Gipsy	,,	,,	,,	634	680
* Braeside	,,	,,	,,	265	300
4 Lighters	,,	—	—	500	—
By VICKERS, SONS & MAXIM, LTD., Naval Construction Works, Barrow-in-Furness.					
H.M.S. Vengeance	—	—	British	13,100	13,500
Clan Cumming	—	—	,,	4,809	3,400
Sokoto	—	—	,,	3,080	2,250
Bornu	—	—	,,	3,238	2,250
Ortona	—	—	,,	7,945	10,000
Sabrina	—	—	,,	500	850
Clan Buchanan	—	—	,,	—	2,250

* Compound. † Triple.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
By UNION CO-OPERATIVE SHIPBUILDING CO., Blyth.					
* Reaper	Wood	Steam	British	91	180
* Retriever	,,	,,	,,	92	180
* Roamer	,,	,,	,,	92	180
By RITSON & CO., Maryport.					
* Algores	Steel	Steam	British	375	450
† Thomas Leigh ..	,,	,,	Foreign	791	—
Barge	,,	—	British	ab 105	—
Barge	,,	—	"	ab 105	—
By CAMPER & NICHOLSONS, LTD., Gosport.					
Ilex	Wood	Sail	British	15	—
Boynhied	,,	,,	,,	88	—
Also several small racers.					
By COTTINGHAM BROTHERS, Goole.					
Oceanic	Wood	Sail	British	100	—
New Balderton ..	,,	,,	,,	110	—
By SIDNEY J. DEWDNEY, Brixham.					
Sirdar	Wood	Sail	British	51	—
By FURNESS, WITHY & CO., LTD., West Hartlepool.					
† No. 241	Steel	Steam	British	3,595	—
† ,, 242	,,	,,	,,	3,927	—
† ,, 243	,,	,,	,,	6,494	—
† ,, 244	,,	,,	,,	6,494	—
† ,, 245	,,	,,	Foreign	5,115	—
† ,, 246	,,	,,	,,	6,235	—
† ,, 248	,,	,,	,,	6,225	—
By PENARTH SHIPBUILDING CO., Penarth.					
* Anemone	Wood	Steam	British	13ym	—
By LYTHAM SHIPBUILDING & ENGINEERING CO., Lytham, Lancashire.					
Barge	Steel	—	Foreign	50	—
Barge	,,	—	,,	50	—
* Tug Mystic ..	,,	Steam	British	80	400
Barge	,,	—	Foreign	90	—
Barge	,,	—	,,	80	—
Barge	,,	—	,,	264	—
Barge	,,	—	,,	78	—
* Tug Fyede ..	,,	Steam	British	50	70
* Launch	,,	,,	Foreign	60	210
* Tug Claude ..	,,	,,	British	40	60
* Cargo Fulwood ..	,,	,,	,,	250	330
By OSBOURNE, GRAHAM & CO., Hylton, Sunderland.					
† Thordis	Steel	Steam	Foreign	3,820	300
† Hero	,,	,,	,,	3,719	320
† August Leffler ..	,,	,,	,,	1,950	160
By SMITH'S DOCK CO., LTD. (late Edwards Brothers), North Shields.					
Sirdar	Steel	Steam	British	186	375
Akranes	,,	,,	Foreign	184	375
Andes and Algoma	,,	,,	British	169ea	380ea
Standard	,,	,,	,,	158	350
Brimsnes	Iron	,,	Foreign	168	350
Atlas and Albatros	,,	,,	,,	135ea	330ea
St. Quintin ..	Steel	,,	British	48	120
Bruinvisch & Zeehond	Iron	,,	Foreign	161ea	330ea
Argentina	,,	,,	British	179	380
Kalso	Steel	,,	,,	179	420
Cephalonia ..	,,	,,	,,	180	360
Carthagenia ..	,,	,,	,,	180	350
Panaghi Vagliano	,,	,,	Foreign	765	500
Kuno	,,	,,	British	182	400
Khedive	,,	,,	,,	184	360
No. 621	,,	,,	,,	184	375
City of Manchester and Nos. 627 & 628	,,	,,	,,	190ea	400ea
Voorwaarts ..	,,	,,	Foreign	155	300
By JOHN STEWART & SON, LTD., Blackwall.					
2 Barges	Iron	—	British	110	—
2 Barges	Steel	—	,,	80	—

* Compound. † Triple.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H. P.
By SOUTHAMPTON NAVAL WORKS, Southampton.					
14 Barges	Ir'n& Steel	Sail	British	150ea	—
* Tug Sunshine ..	Steel	Steam	,,	103	391
* ,, Eastham ..	,,	,,	,,	103	384
* ,, Sunrise ..	,,	,,	,,	103	384
* ,, Partington ..	,,	,,	,,	103	481
* ,, Holmgarth ..	,,	,,	,,	—	314
ENGINES AND BOILERS ONLY					
* Tug Valiant	—	,,	,,	—	291
* ,, No. 397	—	,,	,,	—	320
* ,, Lizard	—	,,	,,	—	314
* ,, Wellington	—	,,	,,	—	310
* ,, Onward	—	,,	,,	—	355
* ,, No. 401	—	,,	,,	—	312
* Helen, River Floating Bridge ..	Steel	,,	,,	—	—
By WILLOUGHBY BROS., LTD., Plymouth.					
* Conqueror ..	Steel	Steam	British	150	350
By VOSPER & CO., LTD., Portsmouth.					
Aorangi	Wood	Oil M.	British	—	B.H.P. 9
——	,,	,,	,,	—	2½
Wainni	,,	,,	,,	—	12
——	,,	,,	,,	—	3½
Ruby	,,	,,	,,	—	1
Gordon	,,	,,	,,	—	6
Mosquito	,,	,,	,,	—	2
——	,,	,,	Foreign	—	0½
——	,,	,,	British	—	1
Emerald	,,	Steam	,,	—	I.H.P 70
By JOHN BLUMER & CO., North Dock, Sunderland.					
† Maristow	Steel	Steam	British	3,506	1,850
† Spennymoor ..	,,	,,	,,	2,748	1,580
† Mareotis	,,	,,	,,	3,184	1,600
† Hyades	,,	,,	,,	3,352	2,590
† Hawkwood ..	,,	,,	,,	1,155	1,090
† Cymodocee ..	,,	,,	Foreign	4,060	1,930
By EARLE'S SHIPBUILDING & ENGINEERING CO., LTD., Hull.					
† Assumburg ..	Iron	Steam	Foreign	171	350
† St. Louis and St. Paul	I'n&St'l	,,	British	195ea	400ea
† Bolama	Steel	,,	Foreign	883	600
† Castro and Hydro	,,	,,	British	1,134e	1,500e
† Gris Nez	,,	,,	Foreign	207	430
† Cito	,,	,,	British	819	1,250
† 4 Vessels	,,	,,	,,	198ea	400ea
2 Barges	,,	Sail	,,	100ea	
† Swallow and Swan	,,	Steam	,,	1,004e	1,500e
† Challenger and Ullapool ..	,,	,,	,,	197ea	400ea
† St. Lawrence and St. George ..	Ir'n &Steel	,,	,,	196ea	400ea
† Molopo	Steel	,,	,,	220	500
† Linnet and Swallow	,,	,,	,,	210ea	400ea
† 3 Vessels	,,	,,	,,	198ea	400ea
† 2 ,, ...	,,	,,	,,	206ea	400ea
By A. RUTHERFORD & CO., Birkenhead.					
1085	Wood	Sail	Foreign	10	—
* Syren	,,	Steam	British	15	60
‡ Elizabeth ..	Steel	,,	Foreign	31	78
La Reine	Wood	Sail	British	32	—
* 1092	Steel	Steam	Foreign	45	100
‡ Ekela	,,	,,	British	9	16
* 1103	Wood	,,	,,	8	13
Marie Boké ..	,,	Sail	Foreign	29	—
Dora	,,	,,	,,	18	—
1110	,,	,,	British	18	—
Princess Maud ..	,,	,,	,,	18	—
Also a large number of small craft and repairs.					
By H. FELLOW & SON, Yarmouth.					
Emily	Wood	Sail	British	80	—
* Claudian	Steel	Steam	,,	62	—
Annie	,,	,,	,,	40	—

* Compound. † Triple. ‡ High Pressure.

By Joseph Scarr, Beverley.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Steamer	Steel	Ligh'r	British	70	—
Trawler	,,	,,	,,	70	—
* Beaver	,,	Steam	,,	90	350
* Wellington and Floriken	,,	,,	,,	60ea	300ea
Mars, Mentor and Minerva	,,	Lgh'rs	,,	300ea	—
Evelyn	,,	Barge	,,	250	—
* Chester	,,	Steam	,,	90	300

By Cochrane & Cooper, Ltd., Beverley and Selby.

† Volta	Iron	Steam	British	168	248
† King Harald	,,	,,	,,	228	416
† King Erik	,,	,,	,,	227	390
† Undaunted	Steel	,,	,,	219	430
† Agami and Merlin	Iron	,,	,,	186ea	350ea
† Nandu	,,	,,	,,	185	350
† Olcaria & Petunia	,,	,,	,,	209ea	430ea
† Rhodesia	,,	,,	,,	197	430
† Reginald	,,	,,	,,	191	375
† Sardius	,,	,,	,,	198	390
† Barendsz	,,	,,	Foreign	195	365
† Heemskerk	,,	,,	,,	196	431
† Lindsey	,,	,,	British	201	375
† Amesbury Abbey and Battle Abbey	,,	,,	,,	198ea	420ea
† Buckingham & Rajah	,,	,,	,,	172ea	350ea
† Cephalonia	,,	,,	,,	180	450
† Oceanic	,,	,,	,,	207	500
† Pomona	,,	,,	,,	161	257
† Perim	,,	,,	,,	161	240
† Cedric and Wamba	,,	,,	,,	197ea	390ea
† Rolla	,,	,,	,,	167	375
† Vinolia	,,	,,	,,	201	390
† Assyrian & Brazilian	,,	,,	,,	176ea	360ea
† Venetia	,,	,,	,,	201	390
† Pearl and Ruby	,,	,,	,,	198ea	430ea
† Shamrock	,,	,,	,,	172	350
† Brough	,,	,,	,,	212	500
† Adrian	,,	,,	,,	180	420
† Rinto	,,	,,	,,	167	375
† Duncan	,,	,,	,,	182	400
† Windsor Castle	,,	,,	,,	189	420
† Balmoral Castle	,,	,,	,,	196	420

By J. P. Rennoldson & Sons, South Shields.

† Titan	Steel	Steam	Foreign	616	2,950
† Scotsman	,,	,,	British	105	390
• Stranton	,,	,,	,,	148	495
• Seaton	,,	,,	,,	148	495
• Goole No. 2	,,	,,	,,	56	178
• Goole No. 3	,,	,,	,,	55	178
• Enterprise	,,	,,	,,	70	299
† Providence	,,	,,	Foreign	766	482
† Abeille 10	,,	,,	,,	183	645
† Atlas	,,	,,	,,	323	750
† Newark (engines only)	—	—	—	—	972

By Yarrow & Co., Ltd., Isle of Dogs, Poplar.

Six torpedo boat destroyers, 220 ft. long by 20 ft. 6 in. beam; speed, 31 knots. Foreign Service.

Four Yarrow's patent water-tube boilers for torpedo boats. British Government.

Nine first-class torpedo boats, 152 ft. 6 in. long by 15 ft. 3 in. beam; speed, 27 knots. Foreign Service.

Two first-class torpedo boats, 30 ft. long by 13 ft. 6 in. beam; speed, 23 knots. Foreign Service.

One shallow draft screw launch, 50 ft. long by 10 ft. beam; speed 10 miles. Foreign Service.

Two Yarrow's patent water-tube boilers, for torpedo boats. Foreign Service.

One side paddle-steamer, shallow draft, 100 ft. long by 16 ft. beam. Foreign Service.

One shallow draft paddle-steamer, 61 ft. long by 12 ft. beam. Foreign Service.

• Compound. † Triple.

By Sunderland Shipbuilding Co., Ltd., Sunderland.

Name of Vessel.	Built of	Class	Owners.	G. T. Regis.	I. H.P
Cardiganshire	Steel	Steam	British	3,838	1,650
Wilcannia	,,	,,	,,	4,958	3,500
Denbighshire	,,	,,	,,	3,844	1,650
Suffolk	,,	,,	,,	6,764	3,500
Norfolk	,,	,,	,,	6,764	3,500

By J. L. Thompson & Sons, Ltd., North Sands, Sunderland.

Wilberforce	Steel	Steam	British	3,327	1,200
Milton	,,	,,	,,	3,267	1,400
Abbey Holme	,,	,,	,,	3,433	1,400
Bath City	,,	,,	,,	2,577	1 500
Newton Hall	,,	,,	,,	4,466	2,700
Isel Holme	,,	,,	,,	4,092	1,550
Mariposa	,,	,,	,,	5,259	1,900
John H. Barry	,,	,,	,,	3,396	1,590
Crown Point	,,	,,	,,	6,196	2,775

By A. W. Robertson & Co., Lea Shipbuilding Yard, Canning Town.

8 Steel Grain Elevator Lighters			—	2,000	—
2 Steel Oil Tank Lighters		—	—	200	—
5 Steel Lighters	—	—	—	350	—
33 Iron Lighters	—	—	—	3,245	—

By Wm. Doxford & Sons, Ltd., Pallion, Sunderland.

† Clan Colquhoun	Steel	Steam	British	5,856	3,080
† Tullochmoor	,,	,,	,,	3,519	1,850
† Clan Farquhar	,,	,,	,,	5,858	3,080
† Clan Urquhart	,,	,,	,,	5,854	3,080
† Clan Alpine	,,	,,	,,	3,586	2,080
† Skandia	,,	,,	Foreign	4,527	2,200
† H.M.S. Lee	,,	,,	British	340	6,000

All of turret type except H.M.S. Lee, which is a torpedo destroyer.

By Wm. Gray & Co., Ltd., West Hartlepool.

Raithwaite	—	—	British	3,027	1,500
Claudius	—	—	Foreign	3,520	2,000
Airdale	—	—	British	3,044	1,500
Mundaka	—	—	Foreign	2,396	1,300
Elantsobe	—	—	,,	2,398	1,300
John Coverdale	—	—	British	3,015	1,500
Ras Mora	—	—	,,	3,346	1,700
Inchkeith	—	—	,,	3,757	2,000
Parana	—	—	,,	3,035	1,500
Mavisbrook	—	—	,,	2,101	1,200
Elswick Park	—	—	,,	3,403	1,700
Alderney	—	—	Foreign	3.106	1,500
Beta	—	—	,,	1,984	900
Rowena	—	—	British	3,017	1,500
Glenroy	—	—	,,	2,755	1,300
Olanda	—	—	Foreign	2,164	1,200
Sheppy Allison	—	—	British	2,284	1,250
Darleydale	—	—	,,	3,095	1,500
Wearside	—	—	,,	3,560	2,000
Kilnsea	—	—	,,	2,994	1,500
Harriet	—	—	Foreign	1,392	800
Northlands	—	—	British	2,755	1,300
Sandsend	—	—	,,	3,814	2,000
Eva	—	—	Foreign	3,520	2,000
Helsinborg	—	—	,,	2,308	1,250
Penmount	—	—	British	2,308	1,250
Shirley	—	—	,,	3,403	1,700

By Ropner & Son, Stockton-on-Tees.

† Woodford	Steel	Steam	British	2,937	1,250
† Wandby	,,	,,	,,	3,981	1,500
† Java	,,	,,	Foreign	3,472	1,500
† Barton	,,	,,	British	3,751	1,500
† Floriston	,,	,,	,,	3,429	1,450
† Grosmont	,,	,,	,,	2,840	1,250
† Riverton	,,	,,	,,	3,438	1,450
† Rokeby	,,	,,	,,	3,788	1,300
† Bylands	,,	,,	,,	3,309	1.250
† Gadsby	,,	,,	,,	2,948	1,300
† Eduard Bary	,,	,,	Foreign	3,034	1,200
† London Bridge	,,	,,	British	3,050	1,200

† Triple.

By R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Kent	—	—	British	7,000	3,200
Surrey	—	—	,,	6,980	3,200
Karamea	—	—	,,	7,090	3,200
H.M.S. Viper ..	—	—	,,	354	10,000
Whakatane ..	—	—	,,	7,150	3,200
H.M.S. Bulwark (Machinery only)			,,	—	15,000
Battleship ..	—	—	Foreign	—	4,500
T.B, Destroyer }	Boilers, Auxiliary		,,	—	10,000
H.M.S. Havock }	Machinery, etc.		British	—	400

By Palmer's Shipbuilding & Iron Co., Ltd., Jarrow on Tyne.

† Spiteful	Steel	Steam	British	355	6,000
† Montfort	,,	,,	,,	7,445	3,500
† Peterel	,,	,,	,,	355	6,000
† Manchester Port ..	,,	,,	,,	7,673	3,500
† British Princess ..	,,	,,	,,	9,591	4,400
† British Prince ..	,,	,,	,,	9,591	4,400
† Manchester Merchant	,,	,,	,,	7,673	3 500
† Skipjack } Fitted	with new boilers and			—	6,000
† Speedwell } engines	for H.M. Government.			—	6,000

By Forrestt & Sons, Ltd., Wyvenhoe, Essex.

* Cysne	Steel	Steam	British	70	100
* 4 Pinnaces ..	Wood	,,	,,	15ea	200ea
* Ilo	,,	,,	,,	6	50
6 Canoes	Steel	—	,,	6ea	—
Lighter	,,	—	,,	10	—
* Cutter	Wood	Steam	Foreign	5	50
Pinnace	,,	Sail	,,	7	—
Lighter	Steel	,,	British	14	—
Pump Punt ..	Wood	—	,,	4	—
* Palliser	Steel	Steam	,,	60	200
* Pioneer	,,	,,	,,	11	45
‡ Mulliped	,,	,,	,,	83	150
* 2 Launches ..	Wood	,,	Foreign	10ea	40ea
5 Boats	Steel	—	British	99	—
Launch	Wood	Oil	,,	2	6
‡ Polypode	Steel	Steam	,,	93	150
Cecil Rhodes ..	,,	,,	,,	60	170
7 Boats	,,	Sail	,,	161	—

24 Boats for Rowing and Sailing from 12 to 32 ft.

By Simpson, Strickland & Co., Ltd., Dartmouth.

† Parole	Wood	Steam	British	38	350
a Whimbrel II. ..	,,	,,	,,	—	300
† Saladin	,,	,,	,,	—	45
* Steam Launch ..	Steel	,,	,,	—	40
* ,, ,, ..	,,	,,	,,	—	20
* ,, ,, ..	Wood	,,	Foreign	—	40
† ,, ,, ..	,,	,,	,,	—	34
† ,, ,, ..	,,	,,	,,	—	62
† ,, ,, ..	,,	,,	British	—	48
† ,, ,, ..	,,	,,	,,	—	48
a ,, ,, ..	,,	,,	,,	—	20
* Birdie	,,	,,	,,	—	30
* Mildred	,,	,,	,,	—	30
Steam Launch ..	,,	,,	,,	—	—
† ,, ,, ..	,,	,,	,,	—	—
a ,, ,, 3 boats	,,	,,	,,	—	60
a ,, ,, ..	,,	,,	,,	—	20
a ,, ,, ..	,,	,,	,,	—	14
* ,, ,, ..	,,	,,	Foreign	—	in. 14
† ,, ,, 2 boats	,,	,,	,,	—	5
* ,, ,, ..	,,	,,	British	—	18
* ,, ,, ..	,,	,,	,,	-	8
————	,,	Sail	,,	—	5
* 12 Sets	} Machinery only.				454
a 9 Sets					365

By W. Harkess & Son, East Slipway, Middlesbrough.

† Feronia	Steel	Steam	Foreign	700	500
† Slat	,,	,,	,,	492	450
† Allie	,,	,,	British	1,140	625
† Dorothy	,,	,,	,,	185	400
Barge	,,	—	,,	50	—

* Compound. † Triple. a Quadruple.

By Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick Works, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Torpedo boat destroyer	Steel	Steam	—	340	6,500
,, ,, ,,	Steel	,,	—	360	10,000
Albany	,,	,,	Foreign	3,450	7,500
Hatsuse	,,	,,	,,	15,000	14,500
Idzumo	,,	,,	,,	9,800	14,500
Atlantian ..	,,	,,	British	9,355	4,550
Ledokol 3.. ..	,,	,,	Foreign	907	2,250
Oriflamme ..	,,	,,	British	3,764	1,960
Luciline	,,	,,	,,	3,765	1,960
Saxoleine	,,	,,	,,	3,757	1,960
Angara	,,	,,	Foreign	1,030	1,250
Strombus.. ..	,,	,,	British	6,015	3,100

By Blyth Shipbuilding Co., Ltd., Blyth.

† Moorabool ..	Steel	Steam	British	2,996	1,250
† Everingham ..	,,	,,	,,	3,036	1,250
† Warwick	,,	,,	,,	1,257	950
† Somerford ..	,,	,,	,,	1,824	1,000
† Battenhall ..	,,	,,	,,	1,550	1,000

By W. Dobson & Co., Low Walker, Newcastle-on-Tyne.

Gwynwood ..	Steel	Steam	British	1,084	950
Seine	,,	,,	Foreign	1,351	1,350
Lord Ormonde ..	,,	,,	British	4,536	1,884
Arnage	,,	,,	,,	3,318	1,750
Southwood ..	,,	,,	,,	1,095	950
No. 9	Iron & Steel	—	,,	794	—
Nina	Steel	Steam	,,	1,084	950

By J. T. Eltringham & Co., Stone Quay, South Shields.

* Egyptian Prince..	Steel	Steam	British	130	285
* Grecian Prince ..	,,	,,	,,	127	285
* Pauline	,,	,,	,,	133	285
* Imperial Prince ..	,,	,,	,,	128	285
* Scottish Prince ..	,,	,,	,,	131	285
Chieftain	Iron	,,	,,	148	500
† Commander Cawley	Steel	,,	,,	218	360
* Andromeda ..	,,	,,	,,	130	285
† St. Gothard ..	,,	,,	,,	a. 140	a. 280
† St. Vincent ..	,,	,,	,,	a. 140	a. 280

By Messrs. John Readhead & Sons, South Shields.

Derwen	—	—	—	3,544	1,750
Raithmoor ..	—	—	—	3,112	1,600
Arcadia	—	—	—	3,100	1,600
Enidwen	—	—	—	3,594	1,750
Tresillian	—	—	—	3,585	1,750
Trevessa	—	—	—	3,566	1,750
Mora	—	—	—	3,047	1,750
Margaret	—	—	—	3,585	1,750

By Robert Stephenson & Co, Ltd., Hebburn-on-Tyne.

† West Point ..	Steel	Steam	British	4,813	2,000
† Montauk Point ..	,,	,,	,,	4,809	2,000
† Garonne	,,	,,	Foreign	1,486	1,000
† Loire	,,	,,	,,	1,493	1,000

By C. S. Swan & Hunter, Ltd., Wallsend on-Tyne.

† Newholm	Steel	Steam	British	3,534	1,800
† Kumara	,,	,,	,,	7,229	3,800
† Lucifer	,,	,,	,,	3,883	1,600
a Ivernia	,,	,,	,,	15,512	12,000
† Dacia	,,	,,	Foreign	4,476	1,600
† Saint Dunstan ..	,,	,,	British	4,568	2,300
Milwaukee ..	,,	,,	,,	3,320	—

By Wood, Skinner & Co., Ltd., Bill Quay, Newcastle-on-Tyne.

† Gilderoy	Steel	Steam	British	153	300
† Alroy	,,	,,	,,	153	300
† Crewe	,,	,,	,,	3,139	1,800
† Hugin	,,	,,	Foreign	1,332	950
† Hydra	,,	,,	,,	1,333	950
† Hirundo	,,	,,	,,	2,102	1,300
† Daphne	,,	,,	,,	1,540	950
† Telefon	,,	,,	,,	1,541	950

* Compound. † Triple.

By Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I. H.P.
† Euxinia	Steel	Steam	Foreign	3,648	1,500
† Loch Lintrathen	,,	,,	British	2,789	1,700
† Bloomfield*b* ..	,,	,,	,,	4,455	2,700
† Begonia	,,	,,	,,	3,653	1,800

b Steamer for carrying 6,000 tons of oil in bulk.

By W. White & Sons, Vectis Works, Cowes.

* St. Kilda	Steel	Steam	British	57	120
* Chrysoprase ..	Composite	,,	Foreign	30	78
* Kathleen	Steel	,,	British	70	130
* Volage	Wood	,,	,,	26	72
* Saxon	Steel	,,	,,	44	105
* Cutter	Wood	,,	,,	—	26
* 6 Admiral's Barges	,,	,,	,,	—	26
* 3 Cutters	,,	,,	,,	—	26

By W. Pickersgill, & Sons, Southwick, Sunderland.

Saint Bede ..	—	Steam	British	3,575	—
Manu	—	,,	Foreign	2,060	—
Banderas	—	,,	,,	2,053	—
Achecolanda ..	—	,,	,,	2,057	—
Hornby Castle ..	—	,,	British	3,712	—
Penrith Castle ..	—	,,	,,	3,730	—

By George & Thomas Smith, Rye, Sussex.

Estelle*b*	Wood	Sail	British	54	—
Evelyn	,,	,,	,,	102	—

b This barge is ready for launching. but is postponed till the New Year, so will not be registered at Custom House till then.

By Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees.

Kum Sang ..	Steel	Steam	British	3,237	2,000
Philippeville ..	,,	,,	Foreign	4,074	4,050
Mont Blanc ..	,,	,,	,,	3,144	1,500
India	,,	,,	,,	3,046	1,700
Portugal	,,	,,	,,	3,897	3,500
Stanleyville ..	,,	,,	,,	4,051	4,050
Islanda	,,	,,	British	5,670	2,500
No. 465	,,	,,	,,	3,636	1,800
No. 470	,,	,,	,,	3,820	1,400

Most of these steamers are first-class passenger vessels of expensive type, and in addition to building them, a large amount of repairing work has been done, and some extensive alterations to steamers have been effected.

By W. H. Lean, Falmouth.

Dream	Wood	Sail	British	25	—

By Edwards & Co., Millwall.

* Loreto	Steel	Steam	Foreign	80	120
* Lizard	,,	,,	British	115	230
* 2 Screw Tugs ..	,,	,,	,,	30ea	80ea
* Sirdar & Cerberus	,,	,,	,,	30ea	75ea
Dredger	,,	—	Foreign	90	—
Pontoon	,,	—	,,	10	—
* Paddle-wheel Tug	,,	Steam	,,	35	110
2 Barges	,,	—	,,	70ea	—
† Screw Tug ..	,,	Steam	British	35	100
* Magpie	,,	,,	,,	25	90
‡ 4 Launches ..	,,	,,	Foreign	2ea	15ea
* 2 Screw Tugs ..	,,	,,	,,	30ea	80ea
‡ Cdt. Marchand ..	,,	,,	,,	6	30
* Barge	,,	,,	,,	125	80
‡ Screw Tug ..	,,	,,	,,	35	60
* Cargo Launch ..	,,	,,	,,	64	75
‡ Gertrude and Barriembe	,,	,,	,,	6ea	30ea
‡ Stern-wheel ..	,,	,,	,,	25	60
* Posadas	,,	,,	,,	30	140

* Compound. † Triple. ‡ High Pressure.

By Wigham-Richardson & Co., Ltd., Neptune Works, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I. H.P.
Solo	—	Steam	—	3,642	1,550
Jabiru	—	,,	—	1,406	1,250
Hannover	—	,,	—	7,585	3,206
Drachenfels ..	—	,,	—	7,000	3,000
Weissenfels ..	—	,,	—	3,858	2,200
Shieldrake ..	—	,,	—	1,406	1,250
Schwarzenfels ..	—	,,	—	3,860	2,200
Angara (engines and boilers only)			—	—	1,250

In addition to the above Messrs. Wigham-Richardson & Co., Ltd., have carried out repairs to various vessels.

By H. S. Hansen & Co. (late Charles Hansen & Sons), Minerva Yard, East Cowes.

Endeavour ..	Wood	Steam	British	—	—
Courier	,,	,,	,,	—	—

By Henry Scarr, Haven Shipyard, Hessle.

Medea	Steel	—	British	220	—
Madge	,,	—	,,	220	—
Lightship	Iron & St'l	—	,,	—	—
Elsa	Steel	—	,,	220	—
Cyrus	,,	Sail	,,	155	—
Gleaner	Iron & St'l	,,	,,	125	—
Wilhelmina ..	Steel	,,	,,	130	—
Lightship	Iron & St'l	—	,,	—	—
Essex	Steel	Steam	,,	—	—
Steel Frames for	Lighter	—	,,	180	—
—— Vessel ..	Iron & St'l	Sail	,,	130	—

By Short Brothers, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	N. H.P.
Sborg	Steel	Steam	Foreign	2,105	211
Anglo-Australian	,,	,,	British	4,019	400
Saxon Prince ..	,,	,,	,,	3,471	328
South Australia ..	,,	,,	,,	4,014	400
Avondale	,,	,,	,,	2,094	211
Nedenes	,,	,,	Foreign	1,539	140
Cebriana	,,	,,	British	4,221	380
Winkfield	,,	,,	,,	4,568	450

By T. Turnbull & Sons, Whitby.

† Brinkburn ..	Steel	Steam	British	3,683	281
† Southgate ..	,,	,,	,,	3,691	281
* Onward	,,	,,	,,	358	90
Pearl	,,	Sail	,,	274	—

By Strand Slipway Co., Sunderland.

† Gottfrid	Steel	Steam	Foreign	1,629	159
† Stanton	,,	,,	British	1,097	140
† Brenda	,,	,,	,,	1,150	140

By Robert Thompson & Sons, Sunderland.

* Lynalder	Steel	Steam	British	3,223	290
* Matienzo	,,	,,	Foreign	1,834	190
* Celtic Princess ..	,,	,,	British	3,604	280
* Lynton	,,	,,	,,	3,232	290
* Eros	,,	,,	Foreign	2,663	250
* Zeeburg	,,	,,	,,	3,050	290
Launched sideways from Bridge Dockyard.					
* Protector	Steel	Steam	British	44	25

By Richardson, Duck & Co., South Stockton Iron Shipyar Stockton-on-Tees.

Bardsey	Steel	Steam	British	3,381	294
Clinton	,,	,,	,,	3,381	294
Novington ..	,,	,,	,,	2,537	244
Shandon	,,	,,	,,	3,850	335
Swindon	,,	,,	,,	3,847	306
Sparta	,,	,,	Foreign	2,778	279
Lydie	,,	,,	British	2,657	281
Exmouth	,,	,,	,,	3,922	348
Llanover	,,	,,	,,	3,842	335
Chulmleigh ..	,,	,,	,,	3,922	348

* Compound. † Triple. ** Triple-Compound.

By Sir James Laing & Sons, Ltd., Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	N. H.P.
Tomoana	Steel	Steam	—	7,832	600
Adalia	,,	,,	—	3,847	400
Terek	,,	,,	—	3,860	320
Balakani	,,	,,	—	3,845	320
Runo	,,	,,	—	4,038	520
Caucasian ..	,,	,,	—	4,657	380
Indradevi	,,	,,	—	6,805	560

By Charles Hill & Sons, Cumberland Road, Bristol.

† Bristol City ..	Steel	Steam	British	2,511	312

LIST OF VESSELS ENGINED IN 1899.

By Wm. Allan & Co., Ltd., Scotia Engine Works, Sunderland.

Name of Vessel.	N. H.P.	I.H.P.	Pressure.
† Folmina and Otta ..	315ea	1,600ea	160 lbs. each
† Hendon	200	1,000	170 ,,
† Ormley	360	1,900	200 ,,
† Manchester Importer, Cebriana and Manchester Shipper	380ea	2,000ea	180 ,, each
† Nedenaes	160	800	160 ,,
	2,490	12,900	

By Blair & Co., Ltd., Stockton-on-Tees.

Name of Vessel.	Builders.	I.H.P.
† Thyra and Thordis	Osbourne, Graham & Co. ..	1,500ea
† Gorsemore, Sparta and Lydie ..	Richardson, Duck & Co. ..	1,400ea
† Greenwich, Woodford & Grosmont	Ropner & Son	1,250ea
† Bardsey & Clinton	Richardson, Duck & Co. ..	1,450ea
† Moorabool & Everingham	Blyth Shipbuilding Co. ..	1,400ea
† Wandby, Java, Floriston, and Riverton ..	Ropner & Son	1,500ea
† Zuleika & Bath City	Jos. L. Thompson & Sons ..	1,500ea
† Euxinia	Tyne Iron Shipbuilding Co.	1,500
† Novington ..	Richardson, Duck & Co. ..	1,150
† Barton & Bylands	Ropner & Son	1,400ea
† Shandon, Exmouth and Llanover ..	Richardson, Duck & Co. ..	1,650ea
† Brinkburn and Southgate ..	Thos. Turnbull & Son ..	1,400ea
† Swindon	Richardson, Duck & Co. ..	1,500
† South Australia ..	Short Bros.	1,800
† Maristow	J. Blumer & Co.	1,500
† Rokeby	Ropner & Son	1,550
† Anigar	Fevigs Jernskibsbyggeri ..	1,500
† Gadsby & Eduard Bary	Ropner & Son	1,300ea
† Bristol City ..	Chas. Hill & Sons	1,500
† Mariposa	Jos. L. Thompson & Sons ..	1,900

Total I.H.P. 52,700

By David Rollo & Sons, Fulton Engine Works, Blackstone Street, Liverpool.

Name of Vessel.	I.H.P.	Pressure
Stentor, Engines and Boilers	4,500	180
Gothland, ,, ,, ...	950	165
Neto, One New Cylinder and Boiler ..	—	200
Tampican, Four New Boilers	3,000	180

By The Thames Ironworks, Shipbuilding & Engineering Co., Ltd., Greenwich.

Name of Vessel.	Builders.	I.H.P.	Pressure
† H.M.S. Goliath ..	Chatham Dockyard	13,500	250
† H.M.S. Condor ..	Sheerness Dockyard	1,400	250

---

† Triple.

By George Clark, Ltd., Sunderland.

Tomoana, Wilberforce, Soborg, St. Bede, Adalia, Anglo-Australian, Manu, Banderas, Terek, Balakani, Abbey Holme, Isel Holme, Highgate, Pertusola, Caucasian, Avondale, Achecolanda, Ohio, Spero, Sunningdale, Hornby Castle, Pearith Castle, Winkfield and Huddersfield.

24 vessels. N.H.P. 7,281. All triple-expansion.

By Earle's Shipbuilding and Engineering Co., Ltd., Hull.

Name of Vessel.	Builders.	N.H.P.	I.H.P.	Pressure
† H.M.S. Formidable	Portsmouth	713	15,000	300/250
† Eveline	Foreign ..	50	400	180
† Dubbelman ..	,, ..	50	400	180

Total I.H.P. 15,800.

By Sir C. Furness, Westgarth & Co., Ltd., Middlesbro'.

Name of Vessel.	I.H.P.
Lodsen, Allie, and for Norwegian S.S. ..	700ea
India	1,700
Dalton Hall, and for S.S. No. 111	1,600ea
Manchester Corporation and Manchester Commerce	2,900ea
Hercules and Verona	2,000ea
For Norwegian S.S.	750
Stat. for S.S. No. 32 and Dorothy	400ea
Freiburg and Marburg	2,790ea
Oro	1,800
Barendsz and Heemskerk	450ea
19 Sets	26,850
Land engines	5,650
Total I.H.P.	32,500

By John Stewart & Son, Ltd., Blackwall.

Name of Vessel.	Builders.	I.H.P.	Pressure
† — ..	J. Stewart & Son, Ltd.	1,500	160
* — ..	,,	50	100

Also (1) high-pressure compounded S.S. Brunette's engines, and built new boiler for same; (2) overhauled Ramsgate dredger, &c.; (3) built new boilers for 4 vessels, I.H.P. 1,140.

By Robert Stephenson & Co., Ltd., Engineers, Newcastle-on-Tyne.

Name of Vessel.	Builders.	I.H.P.
† West Point ..	Robert Stephenson & Co. Ltd.	2,000
† Garonne	,,	1,000
† Montauk Point ..	,,	2,000
† Loire	,,	1,000

By the Wallsend Slipway and Engineering Co., Ltd., Newcastle-on-Tyne.

Name of Vessel.	Builders.	I.H.P.
† Torpedo Boat Destroyer	Sir W. G. Armsworth, Whitworth & Co., Ltd.	6,800
† Veria	,,	2,820
† Atlantian	,,	4,550
† Oriflamme, Luciline, and Saxoline ..	,,	1,960ea
† Ledokol 3	,,	2,250
† St. Andrew	C. S. Swan & Hunter, Ld.	4,500
† St. Dunstan	,,	2,300
a Ivernia	,,	12,000
† Anversville, Philipville, and Starleyville ..	Sir Raylton Dixon & Co.	4,050ea
† Hillglen and Rosalie ..	Northumberland Shipbuilding Co.	2,100ea
† No. 83 Ship	,,	2,400
† Prah and Arrage ..	W. Dobson & Co.	1,750ea
† Abarto (Old vessel fitted with new machinery) ..		1,050
Vessels fitted with new boilers		3,200

Total I.H.P. 67,600.

---

* Compound. † Triple.

By the Central Marine Engine Works, West Hartlepool.

Name of Vessel.	Port of Registry.	I.H.P.
Raithwaite and John Coverdale	West Hartlepool	1,500ea
Claudius and Eva	Hamburg	2,000ea
Airedale	London	1,500
Mundeka and Elantsobe	Bilbao	1,300ea
Ras Mora and Shirley	London	1,700ea
Inchkeith	Liverpool	2,000
Parana	Cardiff	1,500
Mavisbrook	Glasgow	1,200
Elswick Park	Newcastle	1,700
Alderney	Tonsberg	1,500
Kumara	Southampton	4,500
Beta	Amsterdam	900
Rowena and Darleydale	West Hartlepool	1,500ea
Glenroy	,,	1,300
Olanda	Rotterdam	1,200
Sheppy Allison	West Hartlepool.	1,250
Wearside	Sunderland	2,000
Kilnsea	Hull	1,500
Harriet	Lyngor	800
Northlands	Cardiff	1,300
Sandsend	West Hartlepool	2,000
Helsingborg	Helsingborg	1,250
Pomount	Falmouth	1,250
	Total	44,650

By Hepple & Co., Ltd., South Shields.

Name of Vessel.	N.H.P.
Reaper and Retriever	50 each
Chieftain	99
Wapping	25

By John Dickinson & Sons, Ltd., Palmer's Hill Engine Works, Sunderland.

Semantha, Baron Eldon, Hesperides, Hyades, Hawkwood, Gregynog, John H. Barry, Arechondo, Lord Ormonde, August Leffler, Indradevi, Cymodocee, J. L. Thompson & Sons', Ltd., No. 380, Blyth Shipbuilding Co.'s No. 100, John Blumer & Co.'s No. 154, and J. W. Taylor. Total; N.H.P. 4,834; I.H.P. 29,004.

By Wm. Doxford & Sons, Ltd., Sunderland.

Name of Vessel.	Builders.	I.H.P.
† Clan Colquhoun	Wm. Doxford & Sons, Ltd.	3,080
† Tullochmoor	,,	1,350
† Clan Farquhar	,,	3,080
† Clan Urquhart	,,	3,080
† Clan Alpine	,,	2,080
† Skandia	,,	2,200
† H.M.S. Lee	,,	6,000

By Vosper & Co., Ltd., Portsmouth.

Steam Engines.

• Cylinders	3 in. and 6 in. by 5 in. stroke	
• 2 ,,	6½ in. ,, 12 in. ,, 7 in. ,,	each
4 ,, (patent)		
• Cylinder	8 in. ,, 16 in ,, 12 in. ,,	

Boilers.

Horizontal	3 ft. 6½ in. by 2 ft. 8 in. diameter
Locomotive	6 ft. 9 in. ,, 3 ft. 6 in. ,,
Vertical	2 ft. 6⅝ in. ,, 2 ft. 7¾ in. ,,
,,	3 ft. 2 in. ,, 1 ft. 8 in. ,,
,,	3 ft. 3 in. ,, 2 ft. 2 in. ,,

Oil Engines.

4 Cylinders	9 in. dia. by 9 in. stroke.	20 B.H.P.
2 single Cylinders	7 in ,, ,, 7 in. ,, ea.	3½ ,,
2 Cylinders	7 in. ,, ,, 7 in. ,, ea.	8 ,,
Single Cylinder	6 in. ,, ,, 6 in. ,,	2 ,,
2 Cylinders	7 in. ,, ,, 7 in. ,,	6 ,,

• Compound. † Triple.

SCOTCH.

By Ailsa Shipbuilding Co., Troon, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
† Hermes	Steel	Steam	Foreign	1,206	800
† Katoomba	,,	,,	British	469	800
† Ziska	,,	,,	,,	168	300
† Mingary	,,	,,	,,	640	1,000
* Barrow Castle	,,	,,	,,	358	500
* The Marchioness	,,	,,	,,	586	650
* The Duchess	,,	,,	,,	586	650
† Glynn	,,	,,	,,	1,106	800
* Fleswick	,,	,,	,,	650	700
* G. A. Savage	,,	,,	,,	370	500

By Ardrossan Dry Dock & Shipbuilding Co., Ardrossan.

* Humber	Steel	Steam	British	280	280

By Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

† Fantee	Steel	Steam	British	3,649	2,649
† Ismore	,,	,,	,,	6,215	3,700
† Vienna	,,	,,	,,	4,169	2,649
† Volcano	,,	,,	,,	411	1,350
c Lake Erie	,,	,,	,,	6,532	3,750

By Caledon Shipbuilding & Engineering Co., Ltd., Dundee.

† Saltees	Steel	Steam	British	1,246	1,700
* Venture	,,	,,	Foreign	1,239	1,000
† Duke of Rothesay	,,	,,	British	1,226	3,000
† Toward	,,	,,	,,	1,246	1,700

By Campbeltown Shipbuilding Co., Campbeltown.

† Cato	Steel	Steam	British	1,268	750
† Gorbea	,,	,,	Foreign	2,041	1,000
† Silvio	,,	,,	British	1,229	750
† Ino	,,	,,	,,	1,240	750
† Sardinero	,,	,,	Foreign	2,035	1,000
† Mambare	,,	,,	British	1,250	750

By Dundee Shipbuilders' Co., Ltd., Dundee.

* Magoary	Steel	Steam	Foreign	348	300
† Windsor Castle	,,	,,	British	242	540
† Magnific	,,	,,	,,	242	540
† Saldana da Gama	,,	,,	Foreign	469	550
† Prestonian	,,	,,	British	804	650
† Balmoral Castle	,,	,,	,,	242	540
† Ravenscraig	,,	,,	,,	350	300

By John Fullerton & Co., Paisley.

† Cimitangi	Steel	Steam	British	342	235
* Burton Port	,,	,,	,,	298	440
* River Fisher	,,	,,	,,	497	750
* Rostrevor	,,	,,	,,	294	450
* Clonaelon	,,	,,	,,	294	450
* Saint Kevin to be launched	,,	,,	,,	650	850

By Gourlay Bros., & Co., Dundee.

† Zealandia	Steel	Steam	Colonial	2,770	3,200
† Minto	,,	,,	,,	1,090	2,900
† Belvoir Castle	,,	,,	British	220	500
† Dreadnought	,,	,,	,,	128	420
† Defender	,,	,,	,,	128	420
† Taymouth	,,	,,	,,	137	420
† Tayside	,,	,,	,,	137	420
† Marwarri	,,	,,	,,	5,620	3,500

By Grangemouth Dockyard Co., Grangemouth, N.B.

† Irene	Steel	Steam	Foreign	1,820	1,200
† Sirdar	,,	,,	British	1,815	1,000
† Syriam	,,	,,	,,	1,427	1,150
† Kokine	,,	,,	,,	1,427	1,150
† Engineer	,,	,,	,,	850	700
Lakeside	,,	Sail	,,	850	—

By John Shearer & Son, Kelvinhaugh, Glasgow.

* C. & C. Achaque	Steel	Steam	Foreign	196	250
* A. Achaque	,,	,,	,,	196	250
* Dunlossit	,,	,,	British	285	250
* Helen	,,	,,	,,	285	250

---

* Compound. † Triple. c Displacement.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
By George Duncan, Bankhead, Macduff, N.B.					
The Sirdar ..	Wood	Sail	British	40	—
Nellie	,,	,,	,,	40	—
By Wm. Hamilton & Co., Port-Glasgow.					
† Waddon	Steel	Steam	British	3,695	1,600
† Warfield	,,	,,	,,	3,695	1,600
† Cragoswald ..	,,	,,	,,	3,695	1,600
† Winchester ..	,,	,,	,,	3,695	1,600
† Claverdon.. ..	,,	,,	,,	3,695	1,600
† Croham	,,	,,	,,	3,695	1,600
† Adato	,,	,,	,,	3,695	1,600
By Irvine Shipbuilding & Engineering Co., Ltd., Irvine.					
† Forth, Greta, Jed and Kennet ..	Steel	Steam	British	168ea	262ea
† Active, Eclipse, Hope and Rapid	,,	,,	,,	185ea	400ea
* Irishmen	,,	,,	,,	220	320
† Paris	,,	,,	,,	650	650
* Birkerforce ..	,,	,,	,,	438	550
† No. 16	,,	,,	,,	690	650
By London & Glasgow Engineering & Iron Shipbuilding Co., Ltd., Govan, Glasgow.					
† Spithead	Steel	Steam	British	4,697	2,600
† Lakonia	,,	,,	,,	4,686	3,700
H.M. Gunboat Thistle	—	—	,,	disp. 700	1,300
H.M. Tug Advice..	—	—	,,	700	1,250
H.M. Tug Cracker	—	—	,,	700	1,250
By Murdoch & Murray, Port-Glasgow.					
Valetta	—	—	British	3,017	1,400
Neptuno	—	—	Foreign	442	780
Wallsend	—	—	,,	500	680
Bothnia	—	—	,,	1,338	765
Itucuman ..	—	—	,,	298	490
Jurua	—	—	,,	342	550
Tupa	—	—	,,	298	490
Jurupary	—	—	,,	283	490
By Ritchie, Graham & Milne, Whiteinch, Glasgow.					
8 Barges	Steel	—	—	870	—
1 Stern Wheel Stea	,,	—	—	95	120
1 ,,	,,	—	—	260	550
1 ,,	,,	—	—	170	160
1 ,,	,,	—	—	100	110
1 ,,	,,	—	—	350	500
1 Barge	,,	—	—	70	—
1 Screw Steamer	,,	—	—	160	180
4 Barges	,,	—	—	480	—
By Scott & Co., Cartsdyke, Greenock.					
Calchas	Steel	Steam	—	6,748	4,500
Machaon	,,	,,	—	6,748	4,500
Alcinous	,,	,,	—	6,748	4,500
Lutra	,,	,,	—	300	450
By A. Munro, Boatbuilder, Ardrishaig.					
Dove	Wood	Sail	British	10	—
Bangalore ..	,,	,,	,,	14	—
Maggie	,,	,,	,,	12	—
By Caird & Co., Ltd., Greenock.					
† Colombia	Steel	Steam	British	3,334	3,000
† Guatemala ..	,,	,,	,,	3,326	3,000
† Assaye	,,	,,	,,	7,376	6,500
By Menzies & Co., Ltd., Inverkeithing, N.B.					
† Horatia	Steel	Steam	British	220	700
By James Miller, St. Monance, N.B.					
Vesper	Wood	Sail	British	35	—
Dayspring ..	,,	—	—	—	—
May Duncan ..	,,	—	—	—	—
Nenown	,,	—	—	—	—
Celtic	,,	—	—	—	—
Children's Friend	,,	—	—	—	—
* Norham Castle ..	,,	Steam	--	85	35

* Compound. † Triple.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
By Cochran & Co., Ltd., Annan, N.B.					
* Bolivar	Steel	Steam	Foreign	25	90
* Tam Turnpenny..	Wood	,,	British	7	15
* Octavio	Steel	,,	Foreign	20	80
Barge	,,	Tow'g	,,	23	—
* Launch	Wood	Steam	British	5	10
* 2 Stern Wheel Steamers	Steel	,,	Foreign	30ea	90ea
* Ethelinda.. ..	Wood	,,	British	5	10
By R. Napier & Sons, Ltd., Govan Yard, Glasgow.					
Eastern	—	—	British	3,585	3,500
Tagus	—	—	,,	5,545	7,500
Trent	—	—	,,	5,570	7,500
By Scott & Sons, Bowling, Glasgow.					
* Gertrude	Steel	Steam	British	383	600
* Lucy	,,	,,	,,	156	220
* Triton	,,	,,	,,	92	120
* Oberon	,,	,,	,,	92	120
† Aira	,,	,,	Foreign	700	600
* Edith	,,	,,	British	229	300
By D. U. Cumming, Blackhill Dock, Glasgow.					
Nos. 83 and 84 ..	Steel	Sail	British	25ea	—
,, 85 ,, 86 ..	,,	,,	,,	31ea	—
,, 87 ,, 88 ..	,,	,,	,,	40ea	—
By William Denny & Brothers, Dumbarton.					
Maidstone ..	—	—	British	539	—
Bavarian	—	—	,,	10,376	—
Paparoa	—	—	,,	6,563	—
Itaura	—	—	,,	5,310	—
Curlew	—	—	,,	633	—
Hibernia	—	—	,,	1,850	—
Anglia	—	—	,,	1,850	—
Sir Walter Scott..	—	—	,,	109	—
Meedoung.. ..	—	—	,,	107	—
Scorpio	—	—	,,	33	—
Barges	—	—	,,	3,930	—
By Napier & Miller, Ltd., Yoker, Glasgow.					
18 Barges	Steel	Sail	British	3,600	—
† Cuzco	,,	Steam	,,	4,500	—
By David J. Dunlop & Co., Inch Works, Port-Glasgow.					
† Amazonense ..	Steel	Steam	British	2,830	1,500
† Don Hugo ..	,,	,,	,,	2,250	2,620
† Von Podbielski ..	,,	,,	Foreign	1,520	1,700
By A. Hall & Co., Footdee, Aberdeen.					
Lord Kitchener ..	—	Steam	British	199	450
Paragon	—	,,	,,	202	450
Viceroy	—	,,	,,	149	350
Ambassador ..	—	,,	,,	149	350
Tento	—	,,	,,	147	350
Titania	—	,,	,,	173	450
By Hawthorns & Co., Ltd., Leith.					
† Rob Roy	Steel	Steam	British	152	300
† Conqueror ..	,,	,,	,,	148	300
* May	,,	,,	,,	241	550
† Commander ..	,,	,,	,,	148	300
† Chieftain ..	,,	,,	,,	148	300
† Progress . ..	,,	,,	,,	273	500
† Speedwell	,,	,,	,,	273	500
† Alpha	,,	,,	,,	ab250	400
By D. & W. Henderson & Co., Partick, Glasgow.					
† Rembrandt ..	Steel	Steam	British	4,668	3,200
† Border Knight ..	,,	,,	,,	3,730	1,700
† Hyson	,,	,,	,,	6,608	4,400
Gleniffer	—	,,	,,	317	—
† Cuzco	Machinery only		,,	—	2,300
† Nyassa			,,	—	1,100
By S. M'Knight & Co., Ayr.					
* Seapoint	Steel	Steam	British	600	—
† Granit	,,	,,	Foreign	670	—
* Blanche	,,	,,	British	370	—
† Val de Travers ..	,,	,,	,,	800	—

* Compound. † Triple. a Quadruple.

THE NEW YORK PUBLIC LIBRARY
ASTOR, LENOX AND TILDEN FOUNDATIONS.

By ALLEY & MACLELLAN, Sentinel Works, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Caisson	—	—	—	86	—
4 Barges	—	—	—	19ea	—
2 ,, ...	—	—	—	922ea	—
Barge	—	—	—	70	—
,, ...	—	—	—	36	—
Pontoon	—	—	—	17	—
Screw	—	Steam	—	34	100
,, ...	—	,,	—	190	200
Paddle	—	,,	—	200	100

JOHN SCOTT & Co., Kinghorn, Fifeshire.

† Lancashire ..	Steel	Steam	British	490	1,100
† Claughton ..	,,	,,	,,	490	1,100
* Tantallon Castle..	,,	,,	,,	393	1,300
† Una	,,	,,	,,	1,407	1,426
* Stirling Castle ..	,,	,,	,,	271	1,000

By THOMAS B. SEATH & Co., Rutherglen.

* Clanranald ..	Steel	Steam	British	60	125
* 4 Cargo Vessels ..	,,	,,	,,	300ea	300ea
* Sol..	,,	,,	,,	40	85
* Hutton	Iron	,,	,,	120	285
3 Coaling Lighters	Steel	—	,,	36ea	—
* Napo	,,	,,	Foreign	65	70
2 Cargo Barges ..	,,	—	,,	25ea	—
2 ,, ,, ..	,,	—	,,	56ea	—
2 ,, ,, ..	,,	—	,,	47ea	—

By WILLIAM FIFE & SON, Fairlie, Paisley.

Mirza	Wood	Sail	British	24	—
Nance	,,	,,	,,	9	—
Tringa	,,	,,	,,	5	—
Kismet	,,	,,	,,	16	—
Pierrette	,,	,,	,,	—	—
Yvette	,,	,,	,,	—	—
Petula	,,	,,	,,	18	—
Acsenov	,,	,,	,,	20	—

By ARCHD. MCMILLAN & SON, LTD., Dockyard, Dumbarton.

Lord Erne ..	Steel	Steam	British	4,320	—
Hylas	,,	,,	,,	4,233	—
Honorius	,,	,,	,,	3,476	—
Hortensius ..	,,	,,	,,	3,472	—
Kelvingrove ..	,,	,,	,,	3,092	—
Pena Castillo ..	,,	,,	Foreign	1,640	—
Rourik	,,	,,	,,	520	—
Vladimir	,,	,,	,,	520	—

By JOHN BROWN & Co., LTD. (late THE CLYDEBANK ENGINEERING AND SHIPBUILDING Co., LTD.), Clydebank.

Asahi	—	Steam	Foreign	—	—
Duchess of Fife ..	—	,,	British	—	—
Sutlej	—	,,	,,	—	—
Saxonia	—	,,	,,	—	—
No. 336	Machinery only		—	—	—

Totals: tonnage 41,400; I.H.P. 53,480.

By ROBERT DUNCAN & Co., LTD., Port-Glasgow.

† Domingo de Larrinaga	Steel	Steam	British	4,076	1,800
† Spartan Chief ..	,,	,,	,,	1,192	800
† Finanzminister Witte	,,	,,	Foreign	1,180	800
† Josephina.. ..	,,	,,	,,	1,192	800
† Pena Sagra ..	,,	,,	,,	1,590	850

By FLEMING & FERGUSON, LTD., Paisley.

† Poulton	Steel	Steam	British	1,250	1,000
* Nicolai Palibin ..	,,	,,	Foreign	600	500
† Finnieston ..	,,	,,	British	300	600
* Tocorrin	,,	,,	,,	700	800
* Lucy	,,	,,	,,	550	600
* No. 285	,,	,,	,,	300	250
* No. 286	,,	,,	,,	300	250
* Tara	,,	,,	,,	400	700
2 Sets Quadruple-Expansion Engines			—	—	3,000

By T. ORR, Greenock.

* Hilda	Wood	Steam	British	5	5
Also numerous pleasure yacht boats and lifeboats					

* Compound. † Triple.

By A. & J. INGLIS, Pointhouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
† Upada	Steel	Steam	British	5,257	2,800
† Urlana	,,	,,	,,	5,253	2,300
† Dundalk	,,	,,	,,	864	2,200
* Waverley	,,	,,	,,	449	2,600
† Glencoe	,,	,,	,,	800	1,200
† Argyle	,,	,,	,,	457	600

By WILLIAM SIMONS & Co., LTD., Renfrew.

Hopper Dredger..	—	—	Foreign	180	225
2 Dredgers ..	—	—	,,	1,260e	830ea
2 Dredgers ..	—	—	,,	1,500e	1,650e
Pontoons	—	—	,,	515	—
Pontoons	—	—	,,	515	—
4 Hopper Barges..	—	—	,,	490ea	500ea
Dredger	—	—	,,	2,160	1,350
Hopper Dredger..	—	—	,,	1,150	1,170

By JAMES ADAM, Gourock.

Launch	Wood	—	British	2	4
Launch	,,	—	,,	5	6
Launch	,,	—	,,	5	6
3 Yachts	,,	—	Foreign	6	—
7 Yachts	,,	—	British	14	—
3 Yachts	,,	—	,,	6	—

By CHARLES CONNELL & Co., Scotstown Shipbuilding Yard, Whiteinch, Glasgow.

Gairloch	Steel	Steam	British	3,765	—
Texas	,,	,,	Foreign	4,444	—
Alabama	,,	,,	,,	4,452	—
Rajah	,,	,,	British	5,661	—
Ranee	,,	,,	,,	5,659	—
Custodian.. ..	,,	,,	,,	9,200	—

By The FAIRFIELD SHIPBUILDING & ENGINEERING Co., LTD., Govan, Glasgow.

Kinfauns Castle ..	Steel	Steam	British	—	—
Kildonan Castle..	,,	,,	,,	—	—
H.M.S. Cressy ..	,,	,,	,,	—	—
H.M.S. Falcon ..	,,	,,	,,	—	—

Total gross tonnage 31,624. I.H.P. 51,650.
Boadicea steam yacht, new boiler and overhaul.

By HALL, RUSSELL & Co., LTD., Aberdeen.

† Benalder	Steel	Steam	British	150	320
† Salamis	,,	,,	,,	4,508	4,500
† Ben More & Ben Venue	,,	,,	,,	150ea	320ea
† Crimond	,,	,,	,,	173	320
† Insizwa	,,	,,	,,	2,988	2,500
† Cairness & Cortes	,,	,,	,,	173ea	320ea
† Strath More & Strath Bran		,,	,,	162ea	320ea
† Setter	,,	,,	,,	170	350

By LOBNITZ & Co., LTD., Renfrew.

No. 111	—	—	British	100	—
* Porteur No. 4 ..	—	Steam	Foreign	250	300
* Alerta	—	,,	,,	23	90
† Beira and Algarve	—	,,	,,	1,274e	1,400e
* Paul	—	,,	,,	27	90
* Ready and Brisk	—	,,	British	193e	300e
* Valle Nacional ..	—	,,	Foreign	188	200
* San Juan	—	,,	,,	170	220
* Papalcapam ..	—	,,	,,	343	300
† Niels Ebbesen ..	—	,,	,,	872	1,400
† Maynard	—	,,	British	790	900
‡ D'Andrada ..	—	,,	Foreign	85	100
* Sarcelle	—	,,	,,	28	90
* Rio Itecuahy ..	—	,,	,,	100	90
* Dryade, Jouvence, Bacchante, & Alcarazas		,,	,,	163e	150e
Rockcutting and dredging plant, &c., shipped abroad		—	—	500	600

By ALEX. STEPHEN & SONS, Linthouse, Govan.

Bethania	Steel	Steam	Foreign	7,518	4,047
Clan MacAulay ..	,,	,,	British	2,833	2,396
Clan MacLaren ..	,,	,,	,,	2,832	2,396
Montezuma ..	,,	,,	,,	7,345	4,443

* Compound. † Triple. ‡ High Pressure.

By Mackie & Thomson, Govan, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H. P.
† Mercedes	Steel	Steam	Foreign	205	400
† Elgin, Eider, Era, Equator, Erne, Emulator, Hull, Isis, Leven, Mersey, and Nidd ..	,,	,,	British	169ea	300ea
† Neptune and Diana	,,	,,	,,	172ea	450ea
† Undine	,,	,,	,,	185	400
† Pera	,,	,,	,,	1,150	900
† Sea Gull	,,	,,	,,	977	1,100
† Canganian ..	,,	,,	,,	1,200	850

By Ramage & Ferguson, Ltd., Leith.

					N.H.P.
† Shemara	Steel	Steam	British	477	120
† Elba	,,	,,	,,	1,081	146
† Ladye Gipsey ..	,,	,,	,,	373	167
† Aurora and Aries	,,	,,	,,	159ea	54ea
† Golden Eagle ..	,,	,,	,,	356	90
† Panther	,,	,,	,,	236	69
Barge	,,	,,	,,	30	—
† Atlanta	,,	,,	,,	158	54

By John Reid & Co., Ltd., Whiteinch, Glasgow.

b Nyassa	Steel	Steam	British	2,800	1,000
Karanja	,,	,,	,,	132	350
Trombay	,,	,,	,,	132	350
3 Lighters ..	,,	—	,,	400	—

b This vessel was included in last year's tonnage, but was not launched till the beginning of this year.

By Chambers Brothers, Boatbuilders, Greenock.

* Yacht	Wood	Steam	British	30	70

Also 80 Patent Collapsible Lifeboats, total about 300 Tons.

By Russell & Co., Port-Glasgow.

Gymeric	—	Steam	British	4,001	—
Teodoro de Larrinaga	—	,,	,,	3,998	—
Lincolnshire ..	—	,,	,,	3,965	—
Adriatico	—	,,	Foreign	3,963	—
Teresa	—	,,	,,	3,960	—
Mombassa ..	—	,,	British	3,876	—
Auchenarden ..	—	,,	,,	3,618	—
Hilltarn	—	,,	,,	3,548	—
Federica	—	,,	Foreign	3,551	—
Quarnero	—	,,	,,	3,326	—
Tanagra	—	,,	British	3,316	—
Leuctra	—	,,	,,	3,026	—
Anaxo	—	,,	,,	2,985	—
Pydna	—	,,	,,	2,850	—
San Salvador ..	—	,,	Foreign	1,346	—
Bellona	—	,,	,,	1,130	—

By Blackwood & Gordon, Port-Glasgow.

† Cork	Steel	Steam	British	1,280	3,500*
† Clan Macfadyen..	,,	,,	,,	2,816	2,000
Paddle Steamer ..	,,	,,	Foreign	300	—

By A. Rodger & Co., Port-Glasgow.

Recina	—	Steam	Foreign	2,488	1,200
Craigellachie ..	—	,,	British	3,271	1,400
Atbara	—	,,	,,	2,729	1,200
Heros	—	,,	Foreign	2,524	1,200
Axinite	—	,,	British	1,743	900
Citrine	—	,,	,,	1,742	900

By J. McArthur & Co., Abbotswinch, Paisley.

H.M.S. Upnor ..	Steel	Steam	British	364	—
H.M.S. Assurance	,,	,,	,,	230	—
Seabreeze ..	,,	,,	,,	73	—
Caisson and Barges shipped to Colonies	—	,,	,,	574	—

LIST OF VESSELS ENGINED IN 1899.

By Bow, McLachlan & Co., Thistle Works, Paisley.

Total output for 1899, 9,550 I.H.P., comprising:—1 set triple-expansion screw engines, 1,500 I.H.P., for s.s. Bali, Stoomvaart, Maatschappij, "Nederland," Amsterdam; 3 sets paddle engines for China; 1 pair compound surface-condensing screw engines for H.M.S Upnor, British Admiralty; 1 set triple-expansion twin-screw engines for H.M.S. Assurance, British Admiralty; 1 set compound surface-condensing twin-screw engines for s.y. Seabreeze, Andrew Carnegie, Esq., Skibo Castle; 1 set compound surface-condensing stern wheel engines; and 1 set compound surface condensing twin-screw engines, shipped abroad. This firm have also supplied and fitted the steering gears for H.M.S. Pandora, Viper, Bramble, Britomart, Skipjack, Speedwell, Peterel, Spiteful, Upnor, and Assurance.

* Compound. † Triple.

By Ross & Duncan, Whitefield Works, Govan.

Set of compound surface-condensing engines of 500 I.H.P., fitted into s.s. *Fred.*

Set of triple-expansion engines of 400 I.H.P., fitted into s.s. *Mercedes.*

Set of compound surface-condensing engines of 650 I.H.P., fitted into s.s. *Formby.*

Set of compound surface-condensing engines of 500 I.H.P., fitted into s.s. *Algores.*

Set of compound surface-condensing engines of 750 I.H.P., fitted into s.s. *River Fisher.*

Set of compound surface-condensing engines of 575 I.H.P., fitted into s.s. *Blanche.*

Set of triple-expansion engines of 650 I.H.P., fitted into s.s. *Aira.*

Set of triple-expansion engines of 700 I.H.P., fitted into s.s. *Gipsy.*

Set of triple-expansion engines of 800 I.H.P., fitted into s.s. *Bellona.*

Set of triple-expansion engines of 825 I.H.P., fitted into s.s. *Val de Travers.*

Set of triple-expansion engines of 850 I.H.P., fitted into s.s. *Canganian.*

Set of compound suface-condensing engines of 550 I.H.P., fitted into s.s. *G. A. Savage.*

Two sets of compound surface-condensing engines of 120 I.H.P. each, fitted into Coasters.

Six sets of compound surface-condensing engines shipped abroad, 1,255 I.H.P.

One set of twin-screw C. S. C. engines of 100 I.H.P., shipped abroad.

Two sets of triple-expansion engines of 525 I.H.P., shipped abroad.

One set of twin-screw triple-expansion engines of 200 I.H.P., shipped abroad.

Output for 1899, 24 sets of 10,070 I.H.P.

By John Cran & Co., Leith.

Name of Vessel.	Builders.	I.H.P.
†Indian, Arabian, & City of Aberdeen	J. Duthie, Sons & Co...	400 ea.
†Pavonia and Cephalonia	Cochrane & Cooper, Ltd.	450 ea.
*Cruden Bay	William Jarvis.. ..	210
*Dot	John Cran & Co. ..	26
	7 Sets. Total	2,336

By Dunsmuir & Jackson, Govan, Glasgow.

Name of Vessel.	Builders.	I .H .P.
†Gairloch..	Messrs. Chas. Connell & Co.	1,700
*Barrow Castle	Ailsa Shipbuilding Co.	568
†Mingary	,, ,, ,,	1,000
†Sirdar	The Grangemouth Co.	900
†Adato	Messrs. Wm. Hamilton & Co.	1,600
†Rajah	Messrs. Connell & Co.	2,297
†Ranee	,, ,, ,,	2,297
†Custodian	,, ,, ,,	3,600
†Parkside..	Londonderrry Shipbuilding Co.	1,600
5 sets completed, waiting for vessels		6,438

Total I.H.P. 22,000.

* Compound. † Triple.

By Denny & Co., Engine Works, Dumbarton.

Name of Vessel.	Description of Machinery.	Trade.
Bavarian	Triple twin screw	Atlantic
Maidstone	Triple single screw	Channel
Paparoa	Triple twin screw	Colonial
Itaura	Triple single screw	Eastern
Curlew	Triple twin screw	Eastern
Hibernia and Anglia	Triple twin screws	Channel
Meegong	Compound twin screw	River
Scorpio	Compound single screw	River
Schukong	Compound paddle	River

Total I.H.P. 35,700.

By Hall-Brown, Buttery & Co., Govan, Glasgow.

Name of Vessel.	Type of Engines.		I.H.P.
Normanton & Atbara	Triple-expansion.	Scotch boiler	1,500ea
Recina and Heros	,,	,,	1,500ea
Valetta	,,	,,	1,750
Craigellachie	,,	,,	1,750
Neptuno	Compound.	,,	850
Domingo de Larrinaga	Triple-expansion.	,,	2,200
Spartan Chief	,,	,,	900
Finanzminster Witte and Josephina	,,	,,	900ea
Rostrevor and Clonallon	Compound. *	,,	500ea
Karanja and Trombay	,,	,,	400ea
Pena Sagra	Triple-expansion.	,,	950

Total I.H.P. 18,000.

By W. W. V. Lidgerwood, Coatbridge.

Name of Vessel.	Builders.	I.H.P.
† Eclipse, Active, Hope, and Rapid	Irvine Shipbuilding Co.	400ea
† Undine	Mackie & Thomson	400
† Caledonia I. and Donside	J. Duthie, Sons & Co.	400ea
† Dowlais	,, ,,	250

8 sets. Total, I.H.P. 3,050.

By Rankin & Blackmore, Eagle Foundry, Greenock.

Name of Vessel.	Builders.	I.H.P.
† Gymeric, Lincolnshire, and Teodoro de Larrinaga	Russell & Co.	2,050ea
† Auchenarden, Hilltarn, and Federica	,,	1,800ea
† Hylas	,,	2,200

7 sets. Total I.H.P. 13,750.

By McKie & Baxter, Copland Works, Govan, Glasgow.

They have constructed 28 sets of machinery, representing 7,825 I.H.P. 10 sets have been built for vessels launched during the year, and 18 sets have been shipped abroad or made for special purposes at home.

By David Rowan & Co., Glasgow.

Name of Vessel.	Builders.	I.H.P.
Asia, Waddon, Warfield, Cragoswald, Winchester, Claverdon, and Croham	Wm. Hamilton & Co.	1,700ea
Maplemore	C. Connell & Co.	3,300
St. Kilda	A. M'Millan & Son	1,700
Texas and Alabama	C. Connell & Co.	2,100ea
Canadia	A. M'Millan & Son,	1,900
Honorius and Hortensius	,,	2,300ea
Kelvingrove	,,	2,000

Total I.H.P. 29,600. All the engines are of the single-screw triple-expansion type.

† Triple

By Blackwood & Gordon, Port-Glasgow.

Name of Vessel.	Builders.	I.H.P.
† Cork	Blackwood & Gordon	3,500
† Clan Macfadyen	,,	2,000
† Mombassa	Russell & Co.	2,500
† Adriatico	,,	2,500
† Teresa	,,	2,500

IRISH.

By MacColl & Co., Ltd., Belfast.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* No. 5 Ferry	—	Steam	British	35	30
Erne	—	,,	,,	120	—
* Riverside	—	,,	,,	150	150
Workman, Clark & Co., Ltd., Belfast.					
† Brisgavia	Steel	Steam	Foreign	6,576	2,800
† Yangtsze	,,	,,	British	6,457	3,600
† Ping Suey	,,	,,	,,	6,458	3,600
† Star of Australia	,,	,,	,,	7,198	3,200
† Sicilian	,,	,,	,,	6,285	3,200
† Lord Downshire	,,	,,	,,	4,810	2,800
† Rathlin Head	,,	,,	,,	6,754	3,000
Zephyr	Iron	Lghtr.	—	160	—
Aquilo	,,	,,	—	160	—
Africus	,,	,,	—	160	—
† Parisian	(Machinery only)	—	—	—	5,500
† Livonian		—	—	—	2,250
By Harland & Wolff, Ltd., Belfast.					
† Oceanic	Steel	Steam	British	17,274	27,000
† Winifredian	,,	,,	,,	10,405	5,500
a Persic	,,	,,	,,	11,974	5,000
a Michigan	,,	,,	,,	9,494	4,300
† Galeka	,,	,,	,,	6,767	2,750
a Minneapolis	,,	,,	,,	13,750	9,800
a Saxon	,,	,,	,,	12,970	11,800

CANADIAN.

By Polson Ironworks, Toronto.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Majestic	Steel	Steam	Canadn.	200	300
Dream	Composite	,,	,,	10	20
Cutter	,,	,,	,,	15	25
* Cruiser	Wood	,,	,,	100	150
By Laurier, Lane & Co., Quebec.					
Robert Mackay	—	Steam	Canadn.	87	375
Frontenac	—	,,	,,	206	200
No. 4	—	,,	,,	436	350

FRENCH.

By Ateliers et Chantiers de Normandie, Rouen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Elisabeth	Steel	Sail	French	a2,170	—
Seine	,,	,,	,,	a2,170	—
Croisset	,,	,,	,,	a2,700	—
Nantes	,,	,,	,,	a2,700	—
By La Cie. des Messageries Maritimes, La Ciotat.					
† Pacifique	Steel	Steam	French	1,960	1,500
† Atlantique	,,	,,	,,	6,700	3,600
By Les Chantiers de la Seyne.					
† Marechal Floriano	Steel	Steam	Foreign	2,032	3,400
By La Societe Anonyme des Chantiers et Atchars De La Gironde, Bordeaux.					
† Infernel	W'd.& St.	Steam	French	2,450	8,500
† 4 Torpedo Boats	Steel	,,	,,	86	1,500

* Compound. † Triple.

AMERICAN.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
By Bath Iron Works, Bath, Maine, U.S.A.					
Chesapeake ..	Steel	Sail	Americn	1,174	—
† Dalghran and T. A. M. Craven	,,	Steam	,,	148	4,700
† Virginia	,,	,,	,,	750	1,100
By Wm. Cramp & Sons' Ship and Engine Building Co., Philadelphia, U.S.A.					
† Mexico	Steel	Steam	Americn	5,600	5,000
† Variag	,,	,,	Foreign	—	20,000
By Delaware River Iron Shipbuilding & Engine Works, "Roach's Shipyard," Chester, Pa., U.S.A.					
† Hamilton	Steel	Steam	Americn	3,127	3,000
† Jefferson	,,	,,	,,	3,127	3,000
† Aileen	,,	,,	,,	178	500
† Idalia	,,	,,	,,	201	1,000
† Eugenia	,,	,,	,,	a. 250	800
† Alberta	,,	,,	,,	259	2,000
† Governor Dingley	,,	,,	,,	3,826	2,500
By Detroit Shipbuilding Co. (successor to Detroit Dry Docks Co.), Detroit, Mich., U.S.A.,					
* Gen. J. M. Wilson	Steel	Steam	Americn	—	350
Angeline	,,	,,	,,	4,644	1,500
† Columbine ..	,,	,,	,,	4,644	1,500
By Globe Iron Works Co., Cleveland, Ohio, U.S.A.					
† M. A. Hanna ..	Steel	Steam	Americn	4,661	1,700
† H. C. Frick ..	,,	,,	,,	4,713	1,700
a Douglass Houghton	,,	,,	,,	5,332	3,000
By Harlan & Hollingsworth Co., Wilmington, Del., U.S.A.					
† Nantucket ..	Steel	Steam	—	2,600	3,200
† Kershaw	,,	,,	—	2,600	3,200
† Ponce	,,	,,	—	3,503	1,800
† Stringham ..	,,	,,	—	340	7,200
† Maracaibo ..	,,	,,	—	1,771	1,100
† San Juan	,,	,,	—	3,503	1,800
By Maryland Steel Co., 2, Wall Street, New York, U.S.A.					
† Britannia	Steel	St.&Sl	Americn	249	650
† Chester W. Chapin	,,	Steam	,,	2,868	4,200
Pluades	,,	St.&Sl	,,	3,500	1,500
By Newport News Shipbuilding & Dry Dock Co., Newport News, U.S.A.					
† El Sud	Steel	Steam	Americn	4,605	3,800
† El Norte	,,	,,	,,	4,605	3,800
† El Rio	,,	,,	,,	4.605	3,800
† El Cid	,,	,,	,,	4,605	3,800
* El Amigo	,,	,,	,,	150	380
† Comus	,,	,,	,,	5,000 ?	3,800
† Proteus	,,	,,	,,	5,000 ?	3,800
By Neafie & Levy, Penn Works, Philadelphia.					
† Walter A. Luckenbach	Steel	Steam	Americn	434	900
* Waban	,,	,,	,,	163	400
a Josephine	,,	,,	,,	974	3,000
* Syosset	,,	,,	,,	176	700
* Cheltenham ..	,,	,,	,,	113	300
† Lykens	,,	,,	,,	625	1,000
† Augusta	,,	,,	,,	—	3,200
† Edward Luckenbach	,,	,,	,,	—	900
† Richmond ..	,,	,,	,,	—	900
† Covington	,,	,,	,,	—	900
* Ogontz	,,	,,	,,	113	300
By Cleveland Shipbuilding Co., Cleveland, Ohio, U.S.A.					
a Pennsylvania ..	Steel	Steam	Americn	4,840	1,800
† Henry W. Oliver ..	,,	,,	,,	4,909	2,000
† Eureka	,,	,,	,,	2,122	850
a Malietoa	,,	,,	,,	5,229	1,800
By A. Sewall & Co., Bath, Maine, U.S.A.					
Edward Sewall ..	Steel	Sail	Americn	3,206	—
Kainharri	,,	,,	,,	1,570	—
Arthur Sewall ..	,,	,,	,,	8,209	—

* Compound. † Triple. a Quadruple.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	N.H. P.
By Chicago Shipbuilding Co., South Chicago, Ill.					
Illinois	—	Steam	Amer'cn	2,427	1,900
Manila	—	Sail	,,	5,039	—
Maunaloa ..	—	Steam	,,	4,951	2,500
By Columbian Ironworks, Baltimore.					
Piedmont	—	Steam	Amer'cn	377	810
Seminole	—	,,	,,	570	1,500
Savage	—	,,	,,	440	810
Hartford	—	,,	,,	1,554	1,050
By Union Dry Dock Co., Buffalo.					
Buffalo	—	Steam	Amer'cn	3,951	2,258
Tug boat	—	,,	,,	200	350
By Union Works, San Francisco.					
2 Tug Boats ..	—	Steam	Americn	175ea	600e
Union	—	,,	,,	67	200
Californian ..	—	,,	,,	5,630	2,200
San Pablo	—	,,	,,	1,800	1,800
Ohio	—	,,	,,	12,500	14,600
Wyoming	—	,,	,,	3,300	2,400
3 Vessels	—	,,	,,	420ea	8,000e
By Superior Co., West Superior.					
No. 86	—	—	Amer'cn	1,102	—
John Smeaton ..	—	—	,,	5,049	—

SWEDISH.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
By Kockums Mekaniska Verkstads Aktiebolag, Malmo.					
* Mirza-Aga ..	Steel	Steam	Foreign	792	520
* Islam	,,	,,	,,	659	460
Lightship ..	,,	—	Swedish	60	—
By Motala Verkstads Nya Aktiebolag, Motala.					
* Finn	Steel	Steam	Foreign	55	200
* Wermdo III. ..	,,	,,	Swedish	172	250
* Nisse	,,	,,	,,	33	80
* Assistans	,,	,,	Foreign	193	480
By Lindholmens Verkstads, Gothenburg.					
Suleiman Oseinoff	—	Steam	Swedish	1,638	1,200
Erik	—	,,	,,	605	450
Lindholmen ..	—	Barge	,,	135	—
By Jonkspings Værkstads.					
2 Tugs	—	Steam	Swedish	120ea	250ea

DANISH.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
By Aktieselskabet Burmeister & Wain's Maskin og Skibsbyggeri, Copenhagen.					
† Ulabrand	Steel	Steam	Foreign	2,011	950
† Maha Vajiravnah	,,	,,	Danish	779	500
Barge No. 5 ..	,,	Sail	,,	141	—
,, No. 7 ..	,,	,,	,,	196	—
,, No. 8 ..	,,	,,	,,	196	—
† Annam	,,	Steam	,,	5,709	3,000
Barge No. 6 ..	,,	Sail	,,	141	—
† Bornholm ..	,,	Steam	,,	456	700
† Manchuria ..	,,	,,	,,	5,709	3,000
During the same period have docked and repaired 330 steamers representing 400,000 tons.					
By Elsinore Iron Shipbuilding & Engineering Co., Elsinore.					
† Poderhamn ..	Steel	Steam	Foreign	1,499	650
† Anna	,,	,,	,,	1,832	750
† Erika	,,	,,	,,	2,102	900
D.F.D.S. 11 ..	,,	Barge	Danish	342	—
,, 12 ..	,,	,,	,,	459	—
† Nr. 81	,,	Steam	Foreign	2,103	900

* Compound. † Triple.

GERMAN.

By Actien-Gesellschaft "Neptun" Schiffswerft & Maschinen-Fabrik, Rostock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I. H.P.
† Sedina	Steel	Steam	German	1,013	900
† Hans	,,	,,	,,	1,517	650
† Westfalia	,,	,,	,,	996	600
† Denebola	,,	,,	,,	1,358	700
† Marie	,,	,,	,,	1,358	700
† Lusida	,,	,,	,,	1,358	700
† Martha Russ ..	,,	,,	,,	20,074	800
† Ariadne	,,	,,	,,	9,000	550
† Frida Horn ..	,,	,,	,,	2,360	850
* Kuhwärder ..	,,	,,	,,	100	400
By Blohm & Voss, Hamburg.					
a Batavia	Steel	Steam	German	10,300	4,000
a Belgravia.. ..	,,	,,	,,	10,300	4,000
a Tijuca	,,	,,	,,	4,850	2,000
Kaiser Karl der Grosse	—	,,	,,	—	—
a Rhein	Steel	,,	German	10,500	5,400
† Potsdam	,,	,,	Foreign	12,400	7,500
By Flensburger Schiffsbau-Gesellschaft, Flensburg.					
* Gertrud	Steel	Steam	German	816	450
† Secunda	,,	,,	,,	2,025	700
† Saxonia	,,	,,	,,	5,126	2,000
† Harburg	,,	,,	,,	5,217	2,500
† Itzehoe	,,	,,	,,	5,217	2,500
Danske En ..	,,	Sail	Foreign	129	—
Danske To ..	,,	,,	,,	199	—
Danske Tre ..	,,	,,	,,	324	—
† Korea	,,	Steam	,,	5,000	2,700
Danske Fire ..	,,	Sail	,,	142	—
Danske Fem ..	,,	,,	,,	220	—
Danske Sex ..	,,	,,	,,	341	—
* Oro'	,,	Steam	,,	75	160
† Sambia	,,	,,	German	5,500	2,000
By Gebruder Sachsenberg Gesellschaft mit beschrankter Haftung, Rosslau, Elbe, Anhalt.					
* Kaiserin Auguste-Victoria ..	Steel	Steam	German	520*c*	1,300
† Ruhrort V. ..	,,	,,	,,	656*c*	1,000
† Joh. Kuppers II...	,,	,,	,,	656*c*	900
* Stadt Strassburg II.	,,	,,	,,	580*c*	800
* Neptun	,,	,,	,,	220*c*	250
* Velde	,,	,,	Foreign	45*c*	60
* N'Daki	,,	,,	,,	45*c*	60
† StadtStrassburgIII.	,,	,,	German	75*c*	150
No. 456 (praam) ..	,,	—	,,	145*c*	—
No. 457 (lighter) ..	,,	—	,,	40*c*	—
* Vorwärts III. ..	,,	Steam	,,	377*c*	450
* Albrecht Achilles	,,	,,	,,	225*c*	300
* Wilhelmshafen ..	,,	,,	,,	182*c*	300
By Janssen & Schmilinsky, Hamburg.					
* Borstel I... ..	Steel	Steam	German	93	280
* Brunshausen ..	,,	,,	,,	78	140
* Emil	,,	,,	,,	29	65
* Fairplay II. ..	,,	,,	,,	68	280
* Fairplay IV. ..	,,	,,	,,	68	280
* Pirat II.	,,	,,	,,	32	120
‡ 10 A	,,	,,	,,	22	80
* Tack	,,	,,	,,	29	65
* Prompt	,,	,,	,,	36	140
* Carla	,,	,,	,,	36	140
* 7 B	,,	,,	,,	17	60
Max	,,	—	,,	25	—
By Rickmers & Co., Bremerhaven.					
Zukunft (lighter)..	Steel	—	German	675	—
Moderne Kunst(lighter)	,,	—	,,	675	—
† Shantung.. ..	,,	Steam	,,	1,500	950
By Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg.					
a Athesia	Steel	Steam	German	5,750	2,600
a Cap Frio	,,	,,	,,	a5,300	2,900

* Compound. † Triple. ‡ High Pressure. *c* Displacement.

By Johannsen & Co., Danzig.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Express	Steel	Steam	German	125	170
* Odin	,,	,,	,,	94	180
S. No. 109.. ..	,,	Sail	,,	—	—
,, 110.. ..	,,	,,	,,	—	—
* Margarete.. ..	,,	Steam	,,	—	60
* S.S. No. 113 ..	,,	,,	,,	—	260
By J. W. Klawitter, Danzig.					
* D.P. I.	Steel	Steam	German	303	160
† Saxonia	,,	,,	,,	978	650
* D.P. II.	,,	,,	,,	303	160
* Graf Bismarck ...	,,	,,	,,	64	180
* Graudenz	,,	,,	,,	150	250
† Richard	,,	,,	,,	58	180
† Vineta	,,	,,	,,	130	300
* Blitz	,,	,,	Foreign	116	250
* 229	,,	,,	German	1'6	450
* 230	,,	,,	,,	32	90
* 231	,,	,,	,,	390	800
* 232	,,	,,	,,	75	300
* 234	,,	,,	,,	24	150
By Oderwerke Actien Gesellschaft, Stettin.					
* Senior	Steel	Steam	German	303	180
* Gluckauf	,,	,,	,,	30	140
* Luise	,,	,,	,,	27	110
Stengow	,,	,,	,,	100	—
† Viadra	,,	,,	,,	950	500
* Heinrich	,,	,,	,,	32	140
* Ottonie	,,	,,	,,	20	80
† Emil Berenz ..	,,	,,	,,	754	600
* Erich	,,	,,	,,	32	140
† Rhenania	,,	,,	,,	1,350	650
* Harald	,,	,,	,,	24	110
Willy	—	—	—	41	—
Fritz	—	—	—	24	—
Herold	—	—	—	20	—
Hans Joachim von Zieten	—	—	—	34	—
By Schiffswerft von Henry Koch, Lubeck.					
† Portima	Steel	Steam	German	1,489	560
* Vianna	,,	,,	,,	400	150
Kobold	,,	Sail	,,	404	—
Bazar	,,	,,	,,	404	—
† Ydun	,,	Steam	Foreign	1,392	600
† Munin	,,	,,	,,	1,392	600
† Luise Horn ..	,,	,,	German	1,326	600
† Bianca	,,	,,	,,	a1,330	600
By Schiff- und Maschinenbau Actien Gesellschaft "Germania," Kiel.					
† Kaiser Wilhelm der Grosse ..	Steel	Steam	German	11,000	13,000
† Nymphe	,,	,,	,,	2,700	8,000
By J. C. Tecklenborg Bremerhaven, A-G., Geestemunde					
† Koln	Steel	Steam	German	7,410	3,400
† Zanzibar	,,	,,	,,	1,270	550
† Adjutant	,,	,,	,,	380	275
† Frankfurt ..	,,	,,	,,	7,440	3,400
By Heinrich Bradenburg, Hamburg.					
BurgermeisterAben	droth	—	German	325	—
Gatreideleber II...	—	Steam	,,	400	450
2 Tugs	—	,,	,,	27ea	80ea
2 Launches ..	—	,,	,,	18ea	50ea
Hans	—	,,	,,	25	60
Badagry	—	,,	African	28	70
By J. L. Meyer, Papenburg.					
Kaiser Wilhelm II.	—	Steam	German	515	1,000
Stadt Dortmuner I	V. —	,,	,,	54	180
2 Steamers ..	—	,,	,,	689ea	360e
Barge	—	—	,,	96	—
2 Barges	—	—	,,	13ea	—
1 Barge	—	—	,,	20	—

* Compound. † Triple.

By Vulcan & Co., Stettin.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Kaiserin Maria Theresia	Steel	Steam	German	8,285	16,000
a Patricia	,,	,,	,,	13,293	5,300
a Konig Albert	,,	,,	,,	10,642	9,000
a Hamburg	,,	,,	,,	10,642	9,000
a Deutschland	,,	,,	,,	16,000	33,000
† Yakumo	,,	,,	Foreign	—	16,000
By F. Schichau, Danzig.					
a Grosser Kurfurst	Steel	Steam	German	12,500	8,000
By B. Wencke, Hamburg.					
* Brockes	Steel	Steam	German	ab.100	220
* Nehls	,,	,,	,,	ab. 80	220
* Wasserboot IV.	,,	,,	,,	ab.110	85
By Howaldtswerke, Kiel.					
† Oscar Fredrik	Steel	Steam	Foreign	4,500	1,800
Ingeborg	,,	Sail	German	25	—
† Nordstjernan	,,	Steam	Foreign	1,148	650
† Regenstein	,,	,,	German	1,506	550
† Rabenstein	,,	,,	,,	1,507	550
† Prinz Sigismund	,,	,,	,,	697	1,400
† Admiral von Knorr	,,	,,	,,	93	180
† Admiral Roster	,,	,,	,,	93	180
* No. 1	,,	,,	Foreign	438	300
* No. II.	,,	,,	,,	438	300
* No. III.	,,	,,	,,	437	300
† Vera	,,	,,	,,	2,153	900
† Diana	,,	,,	,,	3,325	1,800
* Heinrich	,,	,,	German	80	120
† Podbielski	,,	,,	,,	116	200
By Museke & Co., Stettin.					
2 Vessels	—	Steam	German	220ea	170ea
1 Vessel	—	,,	,,	680	360
1 ,,	—	,,	,,	900	600
Emil	—	,,	,,	30	90
By F. W. Wencke, Bremerhaven.					
4 Lighters	—	—	Foreign	137ea	—
Solide	—	Steam	German	35	65
Schooner	—	—	,,	350	—
By Schiffswerfte und Maschinenfabrik A.-G., Hamburg.					
Borstel I.	—	Steam	German	93	280
Brunhauser	—	,,	,,	73	140
Emil	—	,,	,,	29	65
2 Tugboats	—	,,	,,	68ea	280ea
Pirat II.	—	,,	,,	32	120
10 A	—	,,	,,	22	80
Tack	—	,,	,,	29	66
2 Tugboats	—	,,	,,	36ea	140ea
F.B.	—	,,	,,	17	60
By Bremer Vulkan, Vegesack,					
Steamer	—	Steam	Foreign	366	360
Sperber	—	,,	German	1,265	850
Strauss	—	,,	,,	903	650
Koln	—	,,	,,	692	360
6 Barges	—	—	,,	400	—
Dusseldorf	—	Steam	,,	692	360
By Georg Seebeck, Bremerhaven.					
4 Barges	—	—	German	739ea	—
Nine	—	Steam	,,	843	2,000
2 Trawlers	—	,,	,,	205ea	350e
Launch	—	,,	Foreign	8	30
2 Barges	—	—	German	250ea	—
No. 141	—	—	,,	345	—
By D. W. Kremer & Son, Elmshorn.					
2 Barges	—	—	German	70ea	—
3 ,,	—	—	,,	90ea	—
1 Barge	—	—	,,	85	—
1 ,,	—	—	Foreign	100	—
Viben	—	—	German	155	100
Barge	—	—	,,	90	

* Compound. † Triple. *a* Quadruple.

By Actien Gesellschaft "Weser," Bremen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
* Friesland	Steel	Steam	German	ab.200	350
† Unterweser X.	,,	,,	,,	ab.153	350
† Niobe	,,	,,	,,	a2,000	a8,000
† Deli	,,	,,	,,	ab.900	1,200
* No. 121	,,	,,	,,	ab.200	—
Verschlussponton fur Kaiserdock in Bremerhaven	,,	—	,,	—	—
4 Klappenprahme	,,	—	,,	a. 40ea	—

ITALIAN.

By Geo. Ansaldo & Co., Sestri, Ponente.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
† Garibaldi IV.	Steel	Steam	Italian	4,800	13,500
† Serbia	,,	,,	,,	2,548	1,600
By Orlando Brothers, Leghorn.					
† Varese	Steel	Steam	Italian	—	13,500
† Taranto	,,	,,	,,	1,230	783
By Cantieri Poli, Chioggia, Venice.					
2 Barges	Steel	—	Italian	90	—
4 Ferry Boats	,,	—	,,	—	—
1 Kitchen Boat	,,	—	,,	—	—
46 Barges	Wood	—	,,	12	—
By Societa Esercizio Bacini, Genoa.					
2 Vessels	—	Steam	Italian	164ea	250ea
2 ,,	—	—	—	850ea	850ea

Also a floating dock for Genoa to lift vessels up to 2,900 tons dead weight.

By N. Odero & Co., Genoa.

3 Vessels	—	Steam	Italian	4,048s	1,500

AUSTRIAN.

By Marco U. Martinolich, Lussinpiccolo.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg is	I. H.P.
* Valderthe	Steel	Steam	Austrian	35	80
* Aquileja	,,	,,	,,	45	90
* Nibbio	,,	,,	,,	115	250
By Stabilimento Tecnico, Trieste.					
† Ai Petri	Steel	Steam	Foreign	995	700
† Hydra	,,	,,	,,	220	450
† Sarajeivo	,,	,,	Austrian	654	450
* 3 Steam Tugs	,,	,,	,,	28ea	60ea
By Lloyd Austriaco, Trieste.					
Benaco	—	Steam	Austrian	558	380
Bosnia	—	,,	,,	347	600
Franz Ferdinand	—	,,	,,	6,043	3,600

SPANISH.

By Compania Transatlantica, Cadiz.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
† Felisa	Steel	Steam	Spanish	1,044	600
By Naval Works, Cadiz.					
Extremadura	—	Steam	Spanish	2,030	7,000
Udala	—	,,	,,	2,050	1,000
A	—	,,	,,	350	620
B	—	,,	,,	120	220
Sanlucar	—	,,	,,	160	240
Emilia	—	,,	,,	120	80
4 Launches	—	,,	,,	248	400

* Compound. † Triple.

DUTCH.

By Maatschappij De Maas, Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Zuid-Beveland ..	Steel	Steam	Dutch	350	500
* Kotlin	,,	,,	Foreign	350	250
* Tosmar	,,	,,	,,	350	250
* Gaïnach	,,	,,	,,	350	250
By Maatschappij voor Scheeps- en Werktuigbouw, "Fijenoord," Rotterdam.					
† Mossel	Steel	Steam	Dutch	3,300	1,500
† Spits	,,	,,	,,	350	600
By Nederlandsche Scheepsbouw-Maatschappij, Amsterdam.					
† Soembawa ..	Steel	Steam	Dutch	3,350	1,600
† Heelsum	,,	,,	,,	1,500	750
* Van der Parra ..	,,	,,	,,	360	450
† Flores	,,	,,	,,	3,650	1,600
Floating dock ..	,,	7,500 tons lifting capacity.			
By Royal Shipbuilding and Engineering Co. De Schelde, Flushing.					
† Noord Brabant ..	Steel	Steam	Dutch	—	10,000
a Sindoro	,,	,,	,,	4,900	4,000
† Thor VIII.	(Engines only)	,,	,,	—	300
• Van de Parra		,,	,,	—	500
By Werf Conrad, Ltd., Haarlem.					
* Yin-ye, 1	Steel	Steam	Foreign	440	300
* ,, 2	,,	,,	,,	440	300
* Dineprovskaïa, 22 and 23	,,	,,	,,	250	210
* Wislavskaïa ..	,,	,,	,,	250	210
* No. 203	,,	,,	,,	200	200
* Nos. 204, 205 ..	,,	,,	,,	270	125
* No. 206	,,	,,	,,	800	550
* Volskaïa No. (?) ..	,,	,,	,,	250	210
* ,, No. (?) ..	,,	,,	,,	250	210
By A. F. Smulders, Rotterdam, Holland.					
Bucket Dredger ..	—	Steam	Foreign	700	1,000
Tugboat	—	El'tric	,,	150	200
Floating Elevator	—	,,	,,	300	150
Hopper	—	Steam	,,	350	250
Bucket Dredger ..	—	,,	,,	300	250
4 Hoppers ..	—	,,	,,	1,300	1,000
Tugboat	—	,,	,,	150	220
Bucket Dredger ..	—	,,	,,	670	600
,, ..	—	,,	Dutch	250	250
4 Hopper Barges	—	—	Foreign	250	—
2 ,,	—	—	,,	120	—
4 ,,	—	—	,,	600	—
By J. & W. Mulder, Vierverlaten.					
7 Barges	—	—	British	130ea	—
Nordenham ..	—	—	Foreign	360	180
By J. Drewes, Zindbroeck.					
4 Vessels	—	Sail	Dutch	568	—
By Scheepswerf Voorheen Jan Smitcz, Alblasserdann.					
Leopold Marianne III.	—	Lighte	Dutch	2,096	—
,, ,, IV.	—	,,	,,	1,716	—
2 Vessels	—	Steam	,,	2,150ea	—
By Gebr. G. & H. Bodewes, Martensholk.					
Two Brothers ..	—	Steam	Dutch	45	18
Bertha	—	—	,,	52	—
Mathilde	—	Steam	,,	71	28
Ocean	—	Sail	,,	197	—
2 Lighters.. ..	—	—	,,	44 a	—
2 Vessels	—	—	,,	460ea	—
4 Lighters ..	—	—	,,	185ea	—
Hamburg	—	—	German	65	—
By J. & K. Smit, Kinderdijh and Krimpen.					
Puerto Belgrano..	—	Steam	Foreign	300	450
Governor	—	,,	,,	700	800
2 Vessels	—	—	Dutch	240ea	200ea
Dragon	—	—	,,	470	400
No. 515	—	—	Foreign	170	450

* Compound. † Triple. *a* Quadruple.

NORWEGIAN.

By Akers Mekaniske Vœrksted, Christiania.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
* Björg	Steel	Steam	Norwgn.	31	115
* Louise	,,	,,	,,	134	250
† Tordenskjold ..	,,	,,	Foreign	95	250
* Framnas 2 ..	,,	,,	Norwgn.	86	60
* Ankends	,,	,,	,,	34	40
† Sport	,,	,,	,,	112	250
† Emanuel	,,	,,	,,	82	250
* Steam Launch ..	,,	,,	,,	—	80
By Bergens Mekaniske Værksted A B., Bergen.					
† Grane	Steel	Steam	Norwgn.	1,127	580
† Diana	,,	,,	,,	1,127	580
† Fulton	,,	,,	,,	1 045	530
† Europa	,,	,,	,,	1,045	530

N.B.—The firm has also done a considerable amount of repair work in connection with their dry dock, which is 265 ft. long.

By Fredrikstad Mekaniske Værksted, Fredriksstad.					
† Frank	Steel	Steam	Norwgn.	1,000	600
By Nylands Værksted, Christiania.					
† Balduin	Steel	Steam	Norwgn.	1,017	650
† Irene	,,	,,	Swedish	683	600
† Seirstad	,,	,,	Norwgn.	1,000	650
* Launch	,,	,,	,,	8	20
By Laaxwaags Shipbuilding & Engineering Co., Bergen.					
† Flora	Steel	Steam	Norwgn.	1,082	580
† Volund	,,	,,	,,	1,087	630
† Alma	,,	,,	,,	1,031	580
† Peter Hamre ..	,,	,,	,,	1,090	630
† Ansgarius.. ..	Wood	,,	,,	(Engines only)	400
† Stabil	,,	,,	,,		320
Capri	,,	,,	,,		380
By Trondhjems Vœrksted.					
Frosta	—	Steam	N'we'gn	113	200
Orkdal	—	,,	,,	152	275
Walangen ..	—	,,	,,	275	280
Solstrand	—	,,	,,	187	275
By Fevig Jernskibsbyggeri, Arendal.					
Inercator	—	Steam	N'we'gn	1,083	600
Ladsen	—	,,	,,	1,224	650
Ausgar	—	,,	,,	3,570	1,300
Frida	—	,,	,,	500	650
Anna	—	,,	,,	1,220	200

BELGIAN.

By Societe Anonyme John Cockerill, Hoboken.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	I. H.P.
Dredgers, Nos. 7 & 8	Steel	Steam	Foreign	—	2,600
† Volga	,,	—	,,	—	
Tsaritzine ..	,,	,,	,,	—	200
Tug, No. 1 ..	,,	,,	Belgian	—	150
,, No. 2 ..	,,	,,	,,	—	80
Kempenaar ..	,,	,,	,,	—	150
Brazaville.. ..	,,	,,	,,	—	115
Tug No. 3	,,	,,	Foreign	—	25
,, No. 4	,,	—	Belgian	—	—
Délivrance 2, 3, & 4	,,	Steam	,,	—	60
* Russ, No. 1 ..	,,	,,	Foreign	—	750
* ,, No. 2 ..	,,	,,	,,	—	265
Madeleine.. ..	,,	,,	Belgian	—	75
Felix Faure, 1 & 2	,,	,,	,,	—	60

* Compound. † Triple.

WORK COMPLETED DURING THE YEAR.

English.

MESSRS. THE BLYTH SHIPBUILDING CO., Blyth, have carried out several extensive contracts in ship repairing throughout the year in their two large graving docks attached to their shipyard.

Messrs. R. & W. Hawthorn, Leslie & Co., Limited, St. Peter's Works, Newcastle-on-Tyne, have been well employed in their dry dock department during the year, amongst the various jobs dealt with being the insulated steamship *Buteshire*, which was seriously damaged by fire and scuttling in the colonies, and afterwards placed in this company's hands for reconstruction. The forge department has been exceptionally busy throughout the year.

Messrs. John Readhead & Sons, South Shields, have constructed the machinery and boilers for all the vessels built by them. In their graving dock department they have been well employed during the year, and have done a large amount of repairing work.

Messrs. John Stewart & Son, Limited, Blackwall, have been very busy on repair work and in their dockyard overhauling and repairing steamers, tugs, dredgers, hoppers, sailing vessels, &c.

Mr. Sidney J. Dewdney, Brixham, South Devon, has done an extensive amount of repairing during the year, but finds wooden trawlers not in demand, only launching one.

Messrs. Edward Finch & Co., Limited, have not launched any ships, being too full of general constructional work.

Messrs. the Thames Ironworks, Shipbuilding & Engineering Co., Limited, Blackwall, have not launched any ships, but the battleship *Shikishima*, a steel steamer, built for the Imperial Japanese Government, of 14,850 gross tons register and 14,500 I.H.P., with triple expansion engines, is completed.

Messrs. the Central Marine Engine Works, West Hartlepool, besides the engines built for the 27 ships launched by Messrs Wm. Gray & Co., have constructed a very large set of machinery for the s.s. *Kumara*, for Messrs. the Shaw Savill & Albion Co.'s New Zealand refrigerating trade. In the boiler department, besides the 62 boilers for he engines above named, 13 other marine boilers of various classes have been built, making altogether 75 marine boilers which have been turned out during the year. The works have continued in full employment during the whole year, and, it is gratifying to report, without any labour troubles whatever. Although the figures above given of machinery for vessels launched in 1899, as per shipbuilders' lists, are not quite equal to those of 1898, the actual number of engines fitted on board at the sheers during 1899 has really been greater than ever before, being 33 sets.

Messrs. Allen & Co., Hamworthy, Poole, Dorset, have not built any vessels of iron or wood during the year, but have been busy building barges for carrying stone to Portland Breakwater.

Messrs. S. P. Austin & Son, Limited, have again been exceptionally busy during the year with repairs to hulls and machinery of old vessels, carried out at their graving dock and repairing quays alongside the shipbuilding yard. The premises have been considerably enlarged during the year, and new engine and other repairing shops have been erected which will keep the company in the forefront in being able to execute all classes of ship and engine repairs with the utmost despatch. Electricity has been considerably used for driving machinery. New roads have been formed, and a powerful travelling crane driven by electricity has been erected for use at the graving dock and quay frontage. The graving dock is now fitted with powerful pumping plant, which will empty it in from one to two hours, and the establishment generally is on the very best footing in facilities for giving despatch for all work entrusted to the company, either in the repairing of vessels or machinery or in the construction of new vessels.

Scotch.

Messrs. Cran & Co., Leith, have during the year carried through numerous and extensive overhauls and repairs, which form an important branch of their business.

Messrs. Blackwood & Gordon, Port-Glasgow, have carried out in their dock, and on their slip, the annual overhaul and special repairs to 14 river steamers belonging to the Caledonian S. P. Co. and other companies, to 27 steam yachts, and a number of vessels of various classes.

Messrs. Hawthorns & Co., Limited, Leith, have, in addition to the list of new vessels constructed by them during this year, also carried out some very extensive repairs, including the reboilering and reclassing of Messrs. James Currie & Co.'s steamer *Toledo* and the s.s. *Dale* belonging to the London and Edinburgh Shipping Co., besides a large amount of dry-dock work and general repairs. At their Granton establishments they have been fully employed. The slipway has been well occupied throughout the year, while it is at present engaged for the purpose of lengthening and reboilering the s.s. *Equity*, owned by the Co-operative Wholesale Society, Limited.

Messrs. A. and J. Inglis, Glasgow, have supplied new boilers and engines to several steamers, in addition to a large number of repairs.

Messrs. W. Simons & Co., Limited, Renfrew, have sent to foreign and home ports during the year a large quantity of dredging machinery, boilers, and sand pump plant.

Messrs James Howden & Co., Glasgow, have been exceedingly busy during the past twelve months with contracts for their patent forced-draught system, the amount of work done being considerably greater than in any previous year. Practically every important cargo steamer and passenger liner now contracted for is being fitted with their system.

Irish.

Messrs. The Channel Dry Docks Shipbuilding and Engineering Co., Passage West, co. Cork, have built no new vessels during the past year, but this new firm has been busier than ever known before in the South of Ireland, affording extensive and much-needed employment to the workmen of the district. A very large amount of repairs have been carried out. The longest British sailing ship and a large oil tanker have been more than half rebuilt in their docks.

WORK ON HAND IN BRITISH YARDS.

ENGLISH.

Messrs. Camper & Nicholsons, Ltd., Gosport, have a steam yacht 120 tons, and a 33-ton yawl.

Mr. Sidney J. Dewdney has a ketch on stocks 50 tons, B. of T. measurement, ready for launching, a cruiser ketch building on trawler principles below, with extra quality deck and interior fittings, and another smaller cruiser, ketch rigged of 35 tons register, for Ireland.

Messrs. R. & H. Green, Limited, Blackwall, have building two composite lightships for the Trinity Corporation, and 2,350 tons hopper barges for East London Harbour.

Messrs C. Hansen & Sons.—This firm has been dissolved.—Mr. H. S. Hansen starting business in conjunction with Mr. F. J. Mursell at Minerva Yard, East Cowes, trading as H. S. Hansen & Co. They have building a 60-ft. steam launch, to be named Sir George White, and six rowing boats for the War Department, six 40-ft. steam pinnaces, and five 23-ft. steam cutters for the Admiralty, and a 90-ton yawl yacht for J. K Soames, Esq.

Messrs. Hepple & Co. have transferred their business to Hepple & Co., Limited, Wapping Street South Shields, who are now making two new docks for special accommodation for trawl fishing steamers, the docks to be completed in August, 1900. They have 245 tugs, trawlers, and steamers under repairs of hulls, boilers, or engines, and are fully employed for six months.

Messrs. T. G. Tagg & Son, East Molesey, Surrey, have building—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
* Yasodhara ..	Teak	Steam	British	—	5
* Steam Launch ..	Cedar	,,	,,	—	10
* Steam Launch ..	Steel	,,	,,	—	60

Messrs. Willoughby Bros., Limited, Plymouth, are building two steel water-tank vessels of 390 tons gross, and 300 I.H.P. triple, named *Aid* and *Clinker*, for the Admiralty.

Messrs. The Thames Ironworks, Shipbuilding & Engineering Co., Ltd., Greenwich, are constructing machinery for—

Name of Vessel.	Built at	G.T.R.	I.H.P.
† Duncan	Thames Ironworks	18,000	250
† Cornwallis ..	,,	18,000	250
† Albemarle ..	Chatham Dockyard	18,000	250
† Shearwater ..	Sheerness Dockyard	1,400	250

Also the machinery for 10 56-ft. pinnaces building at Forrestt's, Wyvenhoe, and the machinery for nine 40-ft. pinnaces building at Crampton's, Portsmouth.

---

* Compound. † Triple.

Messrs. The Central Marine Engine Works, West Hartlepool, have for the coming year a large amount of work, including three sets of Mudd's patent five-crank engines, and a powerful set of twin-screw engines for an Atlantic liner.

SCOTCH.

Messrs. The Ailsa Shipbuilding Co., Troon, have one sailing barge and six screw steamers, gross tonnage 5,420.

Messrs. Blackwood & Gordon, Port-Glasgow, have a steel twin-screw crane steamer for the Mersey Docks and Harbour Board, Liverpool, of 600 gross tonnage, named *Hercules*. Repairs and overhauls to several yachts and other vessels.

Messrs. The Caledon Shipbuilding & Engineering Co., Ltd., Dundee, are building—

Name of Vessel.	Built of	Class.	Owners	G.T.R.	I.H.P.
† Caledonian ..	Steel	Steam	British	5,200	3,000
* Salmo	,,	,,	,,	1,540	1,750
* No. 154	,,	,,	Foreign	2,000	900
* No. 155	,,	,,	British	1,000	700

Messrs. Cochran & Co., Annan, Ltd., Annan, N.B.—The business of the firm has now been transferred to most commodious and fully equipped premises on the River Annan, and are now in full working order. A patent slipway is in course of construction, and the following vessels are at present under way:—Two cargo barges to the order of Messrs. Suarez, Hermanos & Co., London, one powerful steam tug to the order of Messrs. E. A. da Costa & Co., Liverpool, and 2 stern wheel steamers to the order of Messrs. Lionel Hart & Co., Liverpool, to ply on the Congo River, which are a repeat order of two built for them last year, and which have proved highly successful.

Messrs. The Dundee Shipbuilders' Co., Limited, Dundee, have three general cargo steamers of about 1,000 tons each, and a single screw tug for Admiralty.

Messrs. Fleming & Ferguson, Limited, Paisley, have five vessels of 3,000 tons gross, and 5,000 I.H.P.

Messrs. Gourlay Bros. & Co., Dundee, have—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
† No. 193	Steel	Steam	Colonial	680	1,400
* No. 194	,,	,,	British	320	900
† No. 195	,,	,,	,,	190	600

Messrs. The Grangemouth Dockyard Co., Grangemouth, have four large vessels.

Messrs. A. Hall & Co., Aberdeen, have building—

Name of Vessel.	Built at	G.T.R.	I.H.P.
No. 380 ..	Plymouth ..	165	410
No. 381 ..	Hull	230	480
No. 382 ..	Aberdeen.. ..	160	360
No. 383 ..	,, ...	150	350
No. 384 & 387	,, ...	155	370
No. 385 & 386	North Shields ..	150ea	350ea

Messrs. Hall, Russell & Co., Limited, Aberdeen, are building—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
† 7 Steamers ..	Steel	Steam	British	150ea	320ea
† 2 ,, ..	,,	,,	,,	175ea	320ea
† 3 ,, ..	,,	,,	,,	170ea	350ea
† 1 ,, ..	,,	,,	,,	1,500	950

Messrs. Hawthorns & Co., Limited, Leith, have good prospects for next year, having booked a considerable amount of new and repair work, including a large screw steam yacht for H.I.H. Archduke Stephen of Austria.

Messrs. The London & Glasgow Engineering & Iron Shipbuilding Co., Limited, Govan, Glasgow, have the 1st Class cruiser H.M.S. *Monmouth*, 9,800 tons displacement, 22,000 I.H.P. for British Admiralty, and a screw steamer of about 4,700 tons gross for London owners.

Messrs. Menzies & Co., Limited, Leith and Inverkeithing, have—

Name of Vessel.	Built of	Class.	Owners	G.T.R.	H.P.I.
† Hermia	Steel	Steam	British	220	700
† Izidoro Antumes	,,	,,	Foreign	300	800

Mr. James Miller, St. Monance, has three steam fishing boats and five sailing boats.

Mr. A. Munro, Ardrishaig, has one boat of 11 tons, near completion, and another in frame of 3 tons, both sail, and for British owners.

* Compound. † Triple.

Messrs. Murdoch & Murray, Port Glasgow, have eight vessels aggregating 2,700 tons.

Mr. T. Orr, Greenock, has a finely equipped lifeboat and gig for steam yacht *Shulah*, also contract booked for first-class yachts boats for a steam yacht building.

Messrs. John Scott & Co., Kinghorn, Fifeshire, have—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
† 1 Cargo Steamer	Steel	Steam	British	1,500	—
* 1 Paddle ,, ..	,,	,,	,,	300	—

Messrs. Scott & Sons, Bowling, Glasgow, have five steamers of about 1,000 tons aggregate.

Messrs. Thomas B. Seath & Co., Rutherglen, have three vessels aggregating 460 tons.

Messrs. Cran & Co., Leith, have in progress six sets of engines for trawlers.

Messrs. Hall, Brown, Buttery & Co., Govan, Glasgow, have in progress engines for vessels building by—

Builders.		I.H.P.	Pressure.
† A. Rodger & Co.	—	1,750	160
† ,, ...	—	1,500	160
* J. Fullerton & Co. ..	—	850	130
† A. Rodger & Co.	—	1,500	160
* J. Fullerton & Co... ..	—	500	130
† A. Rodger & Co.	—	1,750	160
† ,, ...	—	1,500	160
		9,350	

Mr. W. W. V. Lidgerwood, Coatbridge, has four compound sets, and 13 triple sets, aggregating 7,000 I.H.P.

Messrs. McKie & Baxter, Copland Works, Govan, Glasgow, have six sets of engines and boilers to be fitted on board steamers on the Clyde, and have six sets of engines for shipment, representing a total of 3,050 I.H.P.

Messrs. Rankin & Blackmore, Eagle Foundry, Greenock, have nine sets triple-expansion engines of 18,000 collective I.H.P.

IRISH.

Messrs. The Channel Dry Docks Shipbuilding & Engineering Co., Passage West, co. Cork, have the building of five-eighths of the length of a steamer's hull to be connected to the existing after portion of the vessel in their dry dock, a similar achievement to that of the now famous S.S. *Milwaukee*, recently rebuilt in like manner on the River Tyne.

WORK ON HAND IN FOREIGN YARDS.

FRENCH.

Messrs. Ateliers et Chantiers de Normandie, Rouen, reconstructed one year ago, have already booked contracts for 15 vessels, viz: 13 sailing ships and 2 steamers:—

2 three-masted barks, 2,630 deadweight.
9 ,, ,, ,, 3,080 ,,
2 four ,, ,, 3,750 ,,
2 steamers ... ... 5,200 ,, (One is twin-screw.)
All these ships are to be built for French owners.

Messrs. Chantiers et Ateliers de Provence, Marseiller, have on hand 5 vessels, viz.:—

1 Screw Steamer, 4,900 tons gross, 1,200 I.H.P.
1 ,, ,, 4,200 ,, ,, 1,200 ,,
1 ,, ,, 5,600 ,, ,, 1,600 ,,
1 ,, ,, 6,000 ,, ,, 1,600 ,,
1 ,, ,, 4,200 ,, ,, 4,500 ,,
All for French owners.

Messrs. The Compagnie Generale Transatlantique, Penhost, have two vessels which they will launch during 1900.

DUTCH.

Messrs. Maatschappij voor Scheeps - en Werktingbouw, Fyenoord, Rotterdam, have 5 vessels, viz.:—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
† Gelderland	Steel	Steam	Dutch	4,000	10,000
† Gunboat Assahay ...	,,	,,	,,	850	1,400
a Koning Willem II.	,,	,,	,,	7,500	4,000
† Ironclad, 1899 ...	,,	,,	,,	5,000	6,500
† Steam pilot boat ...	,,	,,	,,	440	500

* Compound, † Triple. a Quadruple

Messrs. Royal Shipbuilding and Engineering Co., De Schelde, Flushing, have viz. :—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
a Mail Steamer for Netherland Steam Ship Co.	Steel	Steam	Dutch	4,480	4,000
† Cargo do. do.	,,	,,	,,	...	1,600
Vessels building elsewhere, engines supplied by them—					
Tug boat "Poolzee"	—	Steam	Dutch	—	750
† Battleship "Koningen Regentes"	—	,,	,,	—	6,000

Messrs. Nederlandsche Scheepsbouw Maatschappij, Amsterdam' have 7 vessels, viz. :—

† Timor	Steel	Steam	Dutch	3,650	1,600
† Van Riemsdyk ...	,,	,,	,,	2,000	1,550
† De Klerk	,,	,,	,,	2,000	1,550
† Alting	,,	,,	,,	1,100	750
* Suction hopper ...	,,	,,	,,	300	200
* Hopper	,,	,,	,,	300	200
* Hopper	,,	,,	,,	300	200

Messrs. Werf Conrad, Limited, Haarlem, have 5 building and 1 contracted for, viz.—

† Hoppers 1, 2, 3 ...	Steel	Steam	Argentn.	400	300
* Dredger No. 215 ...	,,	,,	Roumna.	450	550
* Elevator No. 216...	,,	,,	,,	200	75
‡ Dredger for goldsand	—	,,	Col'mbia	50	40

Messrs. J. & W. Mulder, Vierverlaten, have 3 barges of 390 tons for London.

Messrs. J. Drewes, Zindbroeck, have 2 barges of 1,656 tons.

Messrs. G. & H. Bodewes, Martenshoek, have a three-masted schooner of 250 tons for Alloa, and another of 475 tons for Schiedam.

Messrs. J. & K. Smit, Kinderdijk and Krimpen, have a twin-screw hopper-dredger of 860 tons and 600 I.H.P. for Buenos Aires, and three screw steamers, one of 60 tons and 60 I.H.P. and two of 330 tons and 325 I.H.P., for Amsterdam.

ITALIAN.

Messrs. Geo. Ansaldo & Co., Sestri, Ponenti, have, viz—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
2 Torpedo boats ...	Steel	Steam	Italian	145	2,400
2 Passenger & Cargo boats	,,	,,	,,	5,100	4,000

Messrs. Orlando Bros., Leghorn, have—

† "R."	Steel	Steam	Italian	8,272	1,500
† Isola di Favignana	,,	,,	,,	7,400	1,500
† Isola di Levanzo ...	,,	,,	,,	7,400	1,500
† "B 3"	,,	,,	,,	7,400	1,500
† "N"	,,	,,	,,	9,180	4,000

Messrs. M. Odero & Co., Genoa, have—

2 Vessels 4,048 ea. tons gross, and 1,600 ea. I.H.P.
2 ,, 4 040 ea. ,, ,, ,, 1,600 ea. ,,
2 ,, (Engines only) ... 8,000 ,,

NORWEGIAN.

Messrs. Nylands Vœrksted, Christiania, have—

	Tons gross.	I.H.P.	
Nos. 118 & 119, steel, steam, Norwegian,	1,432 ea.,	700 ea.,	triple.
No. 120 ,, ,, ,,	853	650	,,

Messrs. Trondhjems Vœrksted, have—

No. 88 ... screw steamer ... 800 tons. 500 I.H.P.
Nos. 89, 91, & 93 ,, ,, 1,250 ea. ,, 600 ea. ,,
No. 90 ... ,, ,, 400 ,, 550 ,,
No. 92 ... ,, ,, 320 ,, 300 ,,

5 for Bergen, and 1 for Tromso owners.

SWEDISH.

Messrs. Motala Vœrkstads, Nya, Aktiebolag, have 2 vessels, steel, steam, Swedish, 250 ea., I.H.P. Compound.

Messrs. Lindholmens, Verkstads, Gothenburg, have—

1 vessel ... ... 3,500 disp. ... ... 5,000 I.H.P.
1 ,, ... 3,700 ,, ... 5,200 ,,
1 ,, ... 700 tons gross ... 500 ,,

---

* Compound. † Triple. *a* Quadruple.

GERMAN.

Messrs. Actien-Gesellschaft Neptun Schiffswerft & Maschinenfabrik, Rostock, have on hand—

Name of Vessel	Built of	Class.	Owners.	G.T.R.	I.H.P.
† 87	Steel	Steam	German	2,360	850
† 88	,,	,,	,,	900	500
† 89	,,	,,	French	2,400	850
† 90	,,	,,	German	1,500	600
† 91	,,	,,	,,	3,500	1,000
* 92	,,	,,	,,	100	400
† 93	,,	,,	,,	1,500	600

Messrs. Flensburger, Schiffsbau, Gesellschaft, Flensburg.

† No. 196 Druisburg	Steel	Steam	German	5,220	2,500
a No. 197 Cap Verde	,,	,,	,,	6,000	2,800
a No. 200	,,	,,	,,	4,800	2,400
† No. 201	,,	,,	,,	5,220	2,500
a No. 202	,,	,,	,,	5,220	2,500
† No. 203	,,	,,	,,	6,200	2,500
† No. 204	,,	,,	,,	6,200	2,500

Messrs. Janssen & Schmilinsky, Hambur .

* Fri-ia	Steel	Steam	German	168	180
* No. 391	,,	,,	,,	60	220
* No. 392	,,	,,	,,	60	220
* No. 393	,,	,,	,,	120	260
No. 394	,,	—	,,	—	—

Messrs. Oderwerke, Actien, Gesellschaft, Stettin.

† No. 508	Steel	Steam	Foreign	640	1,100
No. 509	,,	,,	German	95	—
* No. 510	,,	,,	,,	24	110
* No. 511	,,	,,	,,	24	110
No. 512	,,	,,	,,	—	—
No. 513	,,	,,	,,	345	—
No. 514	,,	,,	,,	345	—
No. 515	,,	,,	,,	92	—
No. 516	,,	,,	,,	345	—
No. 517	,,	,,	,,	345	—
† No. 518	,,	,,	,,	190	400
† No. 519	,,	,,	Foreign	2,300	2,000
† No. 520	,,	,,	,,	2,300	2,000

Messrs. Rickmers & Co., Bremerhaven, are building—

† Tsintau	Steel	Steam	German	1,500	950
* Chungking ...	,,	,,	,,	1,100	1,500

Mr. F. Schichau, Danzig, have on hand—

Battleship A ...	Steel	Steam	German	11 000*c*	—
Battleship D ...	,,	,,	,,	11,000*c*	—
† Cruiser Nowik ...	,,	,,	Foreign	3,000*c*	17,000

Messrs. Schiffswerft von Henry Koch, Lubeck.

† No. 114	Steel	Steam	German	*a* 1,300	550
† No. 115	,,	,,	,,	*a* 1,180	450
† No. 117	,,	,,	,,	*a* 1,350	600
† No. 124	,,	,,	,,	*a* 1,360	600

Messrs. Vulcan & Co., Stettin.

a Ship 245	Steel	Steam	German	*a*11,000	9 000
a ,, 246	,,	,,	,,	*a*11,000	9,000
a ,, 249	,,	,,	,,	*a*14,700	30,000
† ,, 247	,,	,,	Russia	—	20,000
† ,, 248	,,	,,	German	—	15,000

Mr. B. Wencke, Hamburg.

† No. 90.	Steel	Steam	German	650	300
* No. 91.	,,	,,	,,	80	220

Messrs. Howaldtswerke, Kiel.

9 vessels and 1 Dock	—	—	—	15,045	8100

Messrs. Actien-Gesellschaft "Weser."

† 2 Cruisers... ...	Steel	Steam	—	*a*.2.000	*a*.8,000
4 Dockgates ...	,,	—	German	—	—

Messrs. Museke & Co., Stettin, have five vessels, including a steamer of 2,400 tons and another of 700 tons.

Mr. Georg Seebeck, Bremerhaven, has 4 barges – 90, 620 and two at 739 tons gross; 3 tug boats—two at 30 tons gross and 70 I.H.P. each, and one at 60 tons gross with 180 I.H.P.; one steamer 1,460 tons gross and 1,000 I.H.P. for Shanghai: one trawler 180 tg., and one Launch 12 tg. and 40 I.H.P. for Congo, all the others for German owners.

---

* Compound. † Triple. *a* Quadruple. *c* Displacement.

AUSTRIAN.

Messrs. LLOYD AUSTRIACO, Trieste.

Name of Vessel.	Class.	Owners.	G.T.R	I.H.P.
3 Vessels	Steam	Austrian	2,690ea	1,850ea

BELGIAN.

MESSRS. SOCIETE ANONYME JOHN COCKERILL, Hoboken.

Name of Vessel.	Built of	Class.	Owners.	G.T.R	I.H.P.
CCII	Steel	—	Foreign	—	—
CCIII.	,,	—	,,	—	—
CCXV.	,,	—	Belgian	—	—
CCXVIII.	,,	—	,,	—	—
CCXXI.	,,	—	,,	—	—
CCXXII.	,,	—	,,	—	—
CCXXII.	,,	—	,,	—	—

Also a lot of pirogues, cutters, whaleboats for the Congo.

DANISH.

MESSRS. ELSINORE IRON SHIPBUILDING & ENGINEERING Co, Elsinore.

Name of Vessel.	Built of	Class.	Owners.	G.T.R	I.H.P.
No. 82	Steel	Steam	Foreign	a.2,103	900
No. 83	,,	,,	,,	—	900
No. 84	,,	,,	Danish	—	3,600

AMERICAN.

MESSRS. BATH IRON WORKS, Bath, Maine, U.S.A., have building—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
† Connecticut ..	Steel	Steam	Americn	3,240	2,400
† Bagley					
Barney Biddle ..	,,	,,	,,	167	4,700
* Two Ocean Tugs..	,,	,	,,	525	

MESSRS. THE WM. CRAMP & SONS SHIP & ENGINE BUILDING Co., Philadelphia, U.S.A., have the following vessels under construction—

Name of Vessel	Built of	Class.	Owners.	G.T.R.	I.H.P.
† Alabama	Steel	Steam	Americn	—	10,000
† Retoizan	,,	,,	Russian	—	16,000
† Maine	,,	,,	Americn	—	16,000
† 303 Cuba Mail ..	,,	,,	,,	6,000	8,000
† 304 Sierra ..	,,	,,	,,	6,000	7,500
† 305 Sonoma ..	,,	,,	,,	6,000	7,500
† 306 Ventura ..	,,	,,	,,	6,000	7,500
307 Pontoon ..	,,	—	,,	—	—
308 Caisson ..	,,	—	,,	—	—
† 309 Cuba Mail ..	,,	Steam	,,	4,500	4,500
† 310 ,, ..	,,	,,	,,	4,500	4,500
† 311 Internat.Navig.	,,	,,	,,	12,000	10,000
† 312 ,, ..	,,	,,	,,	12,000	10,000

MESSRS. DELAWARE RIVER IRON SHIPBUILDING & ENGINE WORKS, Roach's Shipyard, Chester, Pa., U.S.A., have building—

† Pennsylvania ..	Steel	Steam	Amerc'n	1,350	3,000
† American ..	,,	,,	,,	6,000	2,500
† Hawaiian ..	,,	,,	,,	6,000	2,500
† No Name yet ..	,,	,,	,,	6,000	2,500

MESSRS. THE CLEVELAND SHIPBUILDING Co., Cleveland, O., U.S.A., have—

a 2 Vessels	—	—	—	5,229a	1,800ea
† 1 Vessel	—	—	—	2,122	850
2 Vessels	—	—	—	—	1,500

MESSRS. HARLAN & HOLLINGSWORTH Co., Wilmington, Del., U.S.A. have building—

† 2 T. P. D. U.S.G.	Steel	Steam	—	400	7,200
† 1 Freight and Passenger. Metropolitan S.S. Co.	,,	,,	—	500	1,600
† 2 Freight Steamers, New York and Baltimore Trapsp. Line ..	,,	,,	—	1,000	900
† Freight and Passenger Steamer, Boston and Philadelphia S.S. Co. ..	,,	,,	—	2,500	2,700
* 3Tugs,Penna.R.R.	,,	,,	—	100 ft.	long.

---

* Compound. † Triple. a Quadruple.

MESSRS. THE GLOBE IRONWORKS Co., Cleveland, O., U.S.A., have—

Name of Vessel.	Built of	Class.	Owners.	G.T.R.	I.H.P.
a 1 Vessel	Steel	Steam	Americn	5,332	3,000
† 1 Vessel	,,	,,	,,	4,713	1,700
2 SteelScrewStmrs	,,	,,	—	—	900

MESSRS. NEWPORT NEWS SHIPBUILDING & DRY DOCK Co, Newport News, U.S.A., have—

U.S. Battleship "Kearsage" 11,525 tons displacement. Will be finished Jan 1st, 1900.
,, "Kentucky" 11,525 tons displacement. Will be finished Feb. 1st, 1900.
,, "Illinois" 11,525 tons displacement.
,, "Missouri" 13,000 ,,
U.S. Monitor "Arkansas" 4,200 ,,
Twin-screw Steamship for Pacific Mail Steamship Co., 18,600 tons displacement.
Twin-screw Steamship for Pacific Mail Steamship Co., 18,600 tons displacement.

MESSRS. THE CHICAGO SHIPBUILDING Co., South Chicago, Illinois, have—

2 Sailing Vessels	5,039 ea.	—
2 — ,, ...	5,500 ea.	2.500 ea.
1 Sailing Vessel	4,300	—
1 — ,, ...	5,100	2,500

MESSRS. THE COLUMBIAN IRON WORKS, Baltimore, have a torpedo-boat destroyer of 3,200 I.H.P. for the U.S.N. and a tug boat of 200 tons and 260 I.H.P.

MESSRS. THE UNION DRY DOCK Co., Buffalo, have a screw steamer of about 4,000 tons, two 50-ft. boats for submarine work, and a fire boat 118 ft. long for the City of Buffalo.

MESSRS. THE SUPERIOR Co., West Superior, have a screw steamer 446 ft. by 50 ft. by 29 ft. 6 in. for the Bessemer Steamship Co.

MESSRS. BELL'S STEAM ENGINE WORKS, Buffalo, have several good-sized contracts and will start as soon as steel markets get a little more settled.

NAVAL ENGINEER APPOINTMENTS.

THE following appointments have been made at the Admiralty, from November 27th to December 21st, 1899:—

Babb, J. F., fleet engineer, has been placed on the retired list, at his own request, with permission to assume the rank of inspector of machinery.

Backler, L., chief engineer to the *Indefatigable*, for recommissioning, to date December 12th.

Block, R. J., engineer to the *Vivid*, for the *Ocean*, to date December 12th.

Brokenshaw, F. (probationary), assistant engineer to the *Highflyer*, to date December 7th.

Bryan, R., engineer to the *Buzzard*, in lieu of a chief engineer, to date December 12th.

Bushby, J. F., engineer to the *Howe*, to date December 12th.

Collings, A. E., engineer to the *Duke of Wellington*, for the *Recruit*, in lieu of a chief engineer, to date December 19th.

Coomber, T. G., fleet engineer to the *Pembroke*, for charge of floating factory *Chasseur*, to date December 12th.

Coope, W. T., fleet engineer, has been placed on the retired list, to date from November 24th.

Coopper, H., engineer to the *President*, additional, as engineer overseer for steamboats, &c., in the London District, including the Isle of Wight, to date December 15th.

Cornish, E., staff engineer to the *Pembroke*, for the *Venerable*, to date November 27th.

Cornish, E., staff engineer, to be fleet engineer, to date December 18th.

Crichton, G. E. A., engineer to the *Indefatigable*, reappointed for three months from date of recommissioning, undated.

David, T. M., assistant engineer to the *Hannibal*, to date December 7th.

Deacon, A. E. C., engineer to the *Assaye*, to date December 12th.

De Paris, Victor, engineer to the *Pembroke*, for the *Porcupine*, undated, in lieu of a chief engineer.

Fincham, W. C., fleet engineer to the *Osborne*, to date December 14th.

---

† Triple. a Quadruple.

Frost, J. J., fleet engineer to the *Vivid*, for the *Bulwark*, to date November 25th.

Green, N. E., engineer, has been placed on the retired list of his rank, at his own request.

Green, T., fleet engineer to the *Colossus*, to date December 13th.

Greene, C. J., assistant engineer to the *Polyphemus*, undated.

Harding, W. J., fleet engineer to the *President*, additional, as engineer overseer at the works of Messrs. Maudslay and Messrs. Thornycroft, to date December 15th.

Heyes, H. W., engineer to the *Pembroke*, for the *Coquette*, undated, in lieu of a chief engineer.

Humphreys, H., chief engineer to the *Speedy*, on commissioning, to date January 16th.

Jennings, R. S., engineer to the *Magdala*, for the *Plassy*, to date December 12th.

Johnson, J. R. D., fleet engineer to the *Polyphemus*, on recommissioning, undated.

Kerr, J., fleet engineer to the *Latona*, on commissioning, to date December 12th.

Laughton, C., engineer to the *Vivid*, for the *Gipsy*, to date December 5th.

Lawrance, W. W., chief engineer to the *Victory*, for the *Chamois*, to date December 15th.

Liversedge, H. T. chief engineer to the *Pembroke*, additional, to date, November 24th, and to the *Dryad* on commissioning, to date December 7th.

Lonnon, W., fleet engineer to the *Vivid*, for the *Agamemnon*, to date November 25th.

Mallinson, E. D., engineer to the *President*, to assist engineer overseer in inspection of naval gun mountings at works of Messrs. Vickers, Son & Maxim, Barrow-in-Furness, to date December 15th.

Marshall, E. H., assistant engineer to the *Polyphemus*, undated.

Milton, W., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Milton, W., staff engineer, to be fleet engineer with seniority of November 7th.

Moffett, E. G. P., staff engineer to the *Pembroke*, for the *Hawke*, to date November 27th.

Moysey, J., fleet engineer to the *Duke of Wellington*, for the *Mercury*, to date November 30th.

Murphy, J., assistant engineer to the *Latona*, to date December 12th.

Nicholls, H. E., assistant engineer to the *Vivid*, supernumerary, to date November 29th.

Pamphlett, W. F., fleet engineer to the *Vivid*, for the *Implacable*, to date December 13th.

Paul, O. R., engineer to the *Highflyer*, to date December 7th.

Peel, H. C. W., chief engineer to the *Severn*, for the *Circe*, to date November 24th.

Purkis, J. T., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Purkis, J. T., staff engineer, to be fleet engineer, with seniority of November 18th.

Rashbrook, H. S., staff engineer, to be fleet engineer, to date December 5th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

The Year's Shipbuilding.

(*From our own Correspondent.*)

INDUSTRIAL and trade matters connected with shipbuilding and engineering during the last month of the year may, as is customary, be merged in a consideration of matters for the whole twelve months which have now spent their course. The year 1899 has proved, as was almost all along evident it would, the record one in the annals of Clyde shipbuilding. Without being particular to a ton or two—considering that minor firms are included, whose work consists almost wholly of small launches and sailing boats—new shipping to the extent of 491,000 tons has been turned out by Clyde shipbuilders, as compared with 466,830 tons last year, which formed the previous record output, and 340,037 tons in 1897. There were no sea-going sailing vessels built on the Clyde during the year, the 14,618 tons of sailing craft, which the subjoined table shows, representing not sailing vessels in the regular sense, but barges and other craft in which steam or other mechanical mode of propulsion had no part. These were of a great variety of types, and for most part were sent in pieces to foreign and, sometimes, very remote regions. The steamships numbered 243, and their aggregate measurement was 476,456 tons, as compared with 284 of 458,087 tons in 1898.

Messrs. Russell & Co., Port-Glasgow, always noted for their big output, are again at the head of the Clyde firms as regards tonnage. The figure to their credit is 52,465 tons, which is 7,910 tons greater than their figure last year, but still much below their output of 1890, when, with two yards going simultaneously, they turned out 70,570 tons, and headed the list of shipbuilding firms in Great Britain. Second place on the Clyde list on this occasion is taken by John Brown & Co., Limited, Clydebank, whose output is represented by 41,400 tons, this being made up by the tonnage of four vessels, whereas Russell & Co.'s is contributed to by as many as 16 vessels, all screw steamers. Messrs. C. Connell & Co., Whiteinch, take third place—as against sixth place last year—with 33,183 tons, and they are closely followed by the Fairfield Co. with 31,624 tons, and by Messrs. Denny Bros., Dumbarton, who with 31,300 tons hold fifth place on this occasion—as against second place last year—with 34,900 tons. Mostly all the firms have bettered their previous year's output, as will be seen from an inspection of the returns.

Readers desirous of instituting a comparison of the yearly outputs over an extended period may be referred to the full table given in these notes last January, the following, however, being the figures for the decade:—

1899	491,074	1896	410,841	1893	280,160
1898	466,832	1895	360,152	1892	336,414
1897	340,037	1894	340,885	1891	326,475

In the lower reaches of the Clyde—that is to say ,below the Castle Rock of Dumbarton, and embracing Dumbarton, Port-Glasgow, and Greenock—the output of the thirteen firms involved reached 213,800 tons, which is the highest figure ever reached in the history of the district. The aggregate was contributed to by 74 vessels, a number of them of considerable tonnage and of high-class character, as will afterwards be made evident.

At the shipbuilding yards of what may be called the outports of the Clyde—viz., those at Troon, Ayr, Irvine, Ardrossan, and Campbeltown—operations during the year have resulted in every case in an increase of output over that of last year, and of the year previous. In the case of the Ailsa Co. at Troon, the increase is not very large, but helping to account for this was the work of re-disposition of berths, and the accessions to the firm's graving dock accommodation carried out during the period. The year's output amounts to 6,139 tons, as compared with 5,347 tons last year, and 4,593 the year previous. The work comprised ten vessels, all steamers, ranging from 200 to 1,200 tons, two of which were high-class steam yachts, for which class of work the company have a high reputation. There are on hand at present six screw steamers and one sailing barque, aggregating 5,420 tons. At Ayr Messrs. S. McKnight & Co., whose output last year amounted to 1,933 tons, have during 1899 turned out 2,400 tons, contributed to by four screw steamers. They have at present on hand two steamers, one of which is a paddle-steamer for the South of England to attain a speed of 20 knots. The Irvine Shipbuilding Co. at Irvine, whose work has mainly consisted of steam trawlers and fleeters has turned out 12 vessels aggregating 3,410 tons, as compared with eight vessels of 2,150 tons last year. The Ardrossan Shipbuilding Co., which, like the other firms named, conduct a repairing business as well, only built one screw steamer of 280 tons gross register. The Campbeltown Shipbuilding Co., from their yard at Trench Point, on Cambeltown Loch, launched six steamers of an average tonnage of 1,510, aggregating 9,063 tons. Last year their aggregate only reached 6,424 tons, and the year previous 4,596 tons.

Analysing in a general way the Clyde shipbuilding returns for 1899, we find that the tonnage of naval work produced amounted to approaching 42,100 tons, which is a surprisingly small proportion of the total output as compared with that of some previous years, although the figure for last year only exceeded this by 3,000 tons. As will be shown, however, the falling away is more apparent than real, as the volume of work being operated upon on the stocks is abnormally high. Considerably more than one-third of the output represents tonnage for the Japanese Government, consisting, in fact, of the 15,200-ton battleship *Asahi*, launched from Clydebank in the month of March. All the remainder represents work for the British Admiralty, and includes the armoured cruisers *Cressy* and *Sutlej*, each of 12,000 tons; two gunboats, the *Thistle* and *Dwarf*, each of 700 tons, and three steam tugs of 411 tons each. During the year also several contracts were completed, and the vessels handed over to the Admiralty. These included the second-class cruisers *Hermes*, *Highflyer*, and *Hyacinth*, each of 5,600 tons.

Deducting the 42,100 tons of naval work launched during the year from the total output leaves as high a figure as 448,900 tons, which in one form or other goes towards the augmentation of the world's mercantile fleet. The variety of purposes for which the tonnage is intended is quite as great on this occasion as in past years. Dredgers and hopper barges have formed no inconsiderable part of the whole, the work of this special class being still for most part in the hands of three firms, Messrs. William Simons & Co., Renfrew; Messrs. Lobnitz & Co., Renfrew; and Messrs. Fleming & Ferguson, Paisley. Messrs. Simons & Co. especially have produced some very notable craft in the way of barge-loading dredgers, of which, along with the notable work presently on hand, more detailed notice will be taken in a future issue. Light-draught steamers, barges, and other craft shipped abroad in pieces, mostly to foreign account, have again been largely turned out by builders who have long been noted for this class of work, *e.g.*, Messrs. Denny & Brothers, Alley & McLellan, Ritchie, Graham & Milne. Steam trawlers, fleeters, and other fishing craft have been produced in as great plenitude as before, although the work is spread over a larger number of firms. The proportion of tonnage to foreign account is not on this occasion as large as in previous years, and, with the increased enterprise of other nations in providing shipbuilding facilities for themselves, this tendency of reduced output may be expected to grow still more marked as time goes on.

The most notable, if not the most numerous, contributory items to the merchant shipping output of the year have been as usual—and more markedly so than for several years—high-class mail and passenger steamships, and huge steamers, combining great carrying capacity with moderate speed and good accommodation for a limited number of passengers. Of both these classes of steamships, and irrespective altogether of war vessels, as many as 21 were over 5,000 tons, and six were over 8,000 tons. From the famous stocks of the Clydebank establishment, now in the hands of John Brown & Co., Limited, there was ushered into her native element the huge twin-screw steamer *Saxonia* for the Cunard Line. As regards gross measurement tonnage this is really the most notable merchant steamer yet built on the Clyde. Her tonnage is, like that of her sister ship *Invernia*, launched during the year on the Tyne, about 13,900 tons gross, whereas the *Campania* and *Lucania*, although about 20 ft. longer between perpendiculars, were only 12,950 tons each. Of course, regarded from the point of view of "work to the ton," the Japanese battleship undergoing completion in the wet dock of the Clydebank Co. is still more notable, as her finished weight of 15,200 tons represents weight of material, not measurement tonnage. There are only three steamers afloat bigger in gross measurement tonnage than the *Saxonia*. These vessels are the *Oceanic* (17,270 tons), the *Deutschland*, of the Hamburg-American Line (15,500 tons), and the *Kaiser Wilhelm der Grosse*, of the North German Lloyds (14,349 tons).

If not the largest, one of the most elaborately fitted, vessels naturally was the twin-screw steamer *Bavarian*, of 10,375 tons, which Messrs. Denny Brothers, Dumbarton, produced for the Allan Line, run hard in every respect by her sister ship, the *Tunisian*, for the same line, which will shortly be launched by Messrs. A. Stephen & Sons, Linthouse. The latter builders turned out early in the year, the twin-screw *Bethania*, of 7,250 tons, for the Hamburg-American Line; and about mid-year the twin-screw steamer *Montezuma*, of about 7,345 tons, for Messrs. Elder, Dempster & Co., Liverpool. From Fairfield stocks there emanated, during the year, two magnificent South African mail steamers, the *Kinfauns Castle* and the *Kildonan Castle*, each of about 9,800 tons, for the Castle Mail Packet Co. From the renowned yard of Messrs. R. Napier & Sons, Govan, came two mail and passenger steamers, the *Tagus* and the *Trent*, each of about 5,550 tons and 7,500 I.H.P., for the Royal Mail Steam Packet Co. Messrs. Caird & Co., Greenock, turned out for their firm friends, the Peninsular and Oriental Co., the *Assaye*, of 7,376 tons, and 6,500 I.H.P.; and Messrs. Scott & Co. sent off their stocks the *Calchas*, *Machaon*, and *Alcinous*, each of 6,748 tons and 4,500 I.H.P., for the Ocean Steamship Co., of Liverpool. Other huge steamships, in which, however, internal fittings were not so elaborate, were the twin-screw *Lake Erie* of 6,532 tons and 3,750 I.H.P., built by Messrs. Barclay, Curle & Co. for Messrs. Elder, Dempster & Co., Liverpool; the twin-screw *Paparoa*, of 6,560 tons, built by Messrs. Denny Brothers for the New Zealand Shipping Co., and the *Itaura*, of 5,310 tons, by the same builders for the British India Steam Navigation Co. For the same owners Messrs. A. and J. Inglis, of Pointhouse, turned out the *Upada* and the *Urlana*, each of 5,250 tons.

The returns of work accomplished on the Clyde during the year in the matter of marine engines and boilers are to a certain extent reflected in the returns as to tonnage, but it is to be remarked that, although there is such an advance in the volume of the latter, the marine engineering side of the account is not commensurately enhanced. As a matter of fact, the indicated horse-power produced is much less for last year than for the year previous, showing that capacious cargo-carrying in conjunction with moderate speed is the order of the day. Clyde engineers constructed engines representing 478,503 I.H.P., as compared with 510,805 I H.P. last year, 373,195 I.H.P. in 1897, 510,815 in 1896, 363,490 in 1895, and 295,620 in 1894.

The firms who conduct engineering concerns independently of any particular shipyard may be referred to with a little more detail. Messrs. David Rowan & Co.'s figure of 29,600 I.H.P. consisted of 15 sets of engines, triple-expansion, the vessels fitted all having been built on the Clyde. Messrs. Muir & Houston's 24,708 I.H.P. was contributed by no fewer than 52 sets of engines, these being almost entirely for steam trawlers, all of which, with the exception of six built on the Humber, were built on the Clyde. Messrs. Dunsmuir & Jackson's 22,000 I.H.P. was spread over 16 sets of engines, fitted into vessels built at Grangemouth, Londonderry, and on the Clyde generally. Messrs. Hall-Brown, Buttery & Co.'s 18,000 I.H.P. was made up by 19 sets of engines, all fitted into vessels built on the Clyde. Messrs. Hutson & Sons' 14,600 I.H.P. was made up by 13 sets of engines, five being fitted into vessels built at Campbeltown, four at Grangemouth, and two at Irving. Messrs. Rankin & Blackmore's 13,750 I.H.P. was spread over seven sets of engines, all fitted to vessels built on the Clyde. Messrs. J. G. Kincaid & Co.'s 12,980 I.H.P. was made up by 15 sets of engines, all for vessels built on the Clyde. Messrs Ross & Duncan's 10,070 I.H.P. was spread over 24 sets of engines, a good number of them being compound surface-condensing, and many of them shipped abroad. Messrs. Bow, McLachlan & Co., Paisley, who constructed 11 sets of engines of 9,550 I.H.P., fitted into vessels built in Paisley, also supplied steering gears for H.M.S.'s *Pandora*, *Viper*, *Bramble*, *Britomart*, *Skipjack*, *Speedwell*, *Petrel*, *Spiteful*, *Upnor*, and *Assurance*. Messrs. McKie & Baxter constructed 28 sets of engines of 7,825 I.H.P., 10 of which were built for vessels launched on the Clyde, and 18 were shipped abroad, or made for special purposes at home. Messrs. Shanks, Anderson, & Co., Polmadie, constructed 14 sets of engines of 4,180 I.H.P., two of the vessels fitted being built on the Humber, two on the Tyne, one at Larne, one on the Forth, and four on the Clyde. Mr. W. V. Ledgerwood, Coatbridge, constructed eight sets of engines of 3,050 I.H.P., all of the triple-expansion type, and fitted to trawlers built on the Clyde and at Aberdeen. Messrs. Campbell & Calderwood, of Paisley, constructed 11 sets of engines of 2,390 I.H.P., fitted into vessels built on the Clyde, and at such remote places as Sebastopol, Australia, and Calcutta. Messrs. Fisher & Co., Paisley, constructed eight sets of engines of 2,085 I.H.P., all of the compound type, fitted to vessels built on the Clyde. Messrs. Lees, Anderson & Co. constructed six sets of engines of 1,500 I.H.P., fitted to twin-screw vessels built at Port-Glasgow.

As regards shipbuilding work on hand in Clyde yards the tonnage presently under construction may be roughly estimated at 450,000 tons gross measurement, including vessels afloat, undergoing completion, the naval tonnage at present on hand on the Clyde for the British and other navies reaches the considerable figure of 125,000 displacement tons. This makes rather more than one-half of the naval work on hand at all the private yards in the kingdom, and constitutes, on the whole, the biggest total for warship work on hand at one time in the history of the shipbuilding industry on the Clyde. With the exception of the Japanese battleship *Asahi*, of 15,200 tons, which the Clydebank establishment has now almost completed, the tonnage is wholly for the British Admiralty. The contracts on hand at Fairfield, including the vessels afloat, amount to 55,000 tons displacement, or more than half the total tonnage at present in hand by other Clyde builders. Besides the 12,000-ton *Cressy*, launched on the 4th of December, there is the sister cruiser *Aboukir*, which is almost entirely plated, in the berth alongside that on which the *Cressy* was erected. Alongside the *Aboukir* there is the 14,100-ton armoured cruiser *Good Hope*, 500 ft. long by 71 ft. breadth extreme, into whose structure, although operations have only been proceeding since August, as much as 1,500 tons of material have been worked. On the berth vacated by the *Cressy*, the keel is being laid of a 9,800-ton cruiser, ordered in May last. In frame, and for the most part plated, are two 30-knot torpedo-boat destroyers, the *Falcon* and *Ostrich*, and in the berth alongside this is well advanced the bottom structure of a 6,500-ton twin-screw troopship ordered by the India Office. This vessel, which is to be named *Hardinge*, is 470 ft. long; 50 ft. 10 in. beam; and 38 ft. deep. She is to steam 18 knots on a six hours' run at loaded draught. The engines, of the triple-expansion type, will indicate 8,000 H.P.

The other Govan firm undertaking Government work, the London and Glasgow Shipbuilding Co., is just at the moment indifferently off with regard to naval work. Apart from two paddle tugs of 410 tons afloat and being completed for the Admiralty, the other work on hand is represented by the 9,800-ton cruiser *Monmouth*, sister ship to the *Bedford*, under way in Fairfield.

As regards naval work on hand at Clydebank, there is afloat in the company's wet dock the battleship *Asahi*, and the cruiser *Sutlej* (sister to the *Cressy*), launched on the 18th November. On the stocks the naval work embraces the 14,100-ton armoured cruiser *Leviathan* (sister ship to the *Good Hope* on hand at Fairfield) which occupies the berth vacated by the *Sutlej*; the *Bacchante*, sister ship to the *Sutlej* and *Cressy*, which is well advanced; and two 30-knot torpedo-boat destroyers. The *Asahi*, which is the second warship built for Japan by the Clydebank establishment, is the heaviest warship ever constructed on the Clyde, and is expected to be ready for her steam-trials in April next. Her length extreme is 405 ft. 6 in.; breadth, 75 ft. 2½ in; and depth, 43 ft. 7½ in.; her displacement tonnage complete being 15,200. The engines, also supplied by the Clydebank Co., are three-cylinder triple-expansion type, and consist of two sets, each of which is expected to develop 7,500 I.H.P., or a total of 15,000. The boilers, 25 in number, are of the Belleville water-tube type with economisers. The speed to be obtained is between 18 and 19 knots per hour.

Of outstanding note in the way of mercantile tonnage still on the stocks mention may first be made of the four large steamers for the American Line in the Clydebank establishment. These vessels are to be known as the *Haverford*, *Merion*, *Vaderland*, and *Zeeland*. The Allan Line *Tunisian*, on the stocks at Messrs. Stephen & Sons has already been alluded to. Messrs. Denny, at Dumbarton, have on hand, besides a palatial steam yacht, intended to be the finest afloat, for Mr. Gordon Bennett, of New York, one or two of the high-speed cross-channel boats for which they are so justly famed, including the twin-screw *Arundel* for the London, Brighton & South Coast Railway and the Western Railway of France. This vessel, which is virtually a repeat of the well-known twin-screw vessel *Sussex*, is intended to be ready early next summer to cope with the anticipated traffic due to the Paris Exhibition on the Newhaven and Dieppe crossing. At Greenock Messrs. Caird & Co. have under progress three steamers for the P. & O. Co., including two 7,240-ton sister-ships to the *Assaye* produced during the year. Messrs. Scott & Co. have on hand, in addition to two steam yachts, four twin-screw steamers, each of 6,700 tons, for the Ocean Steamship Co., of Liverpool, similar to the three turned out during the past year.

As regards the work of the past year in shipyards and engine-shops on the East Coast of Scotland—a province we by no means wish to belittle or overlook—the limits of space unfortunately forbids any very detailed account. Forth shipbuilders, including those on the Fifeshire coast, have not done as well as last year (*tonnage* always being the measure, questionable enough of financial well-being), the aggregate of the six firms involved being 10,000 tons less than the volume of output for the year previous. The shipbuilders of the Tay—three firms included—launched 17,900 tons of new shipping, as against 14,290 tons during 1898. Shipbuilders on the Dee—three firms involved, as in the case of the Tay—beat those on the Tay in the matter of number of vessels involved, having launched 28 vessels, chiefly trawlers, of 11,973 tons.

Curtly as these particulars may appear to be given, they are, nevertheless, all that the space at present disposal permits, although readers of previous months' notes will have no difficulty in filling in important omissions.

THE TYNE.

(From our own Correspondent.)

Shipbuilding.—The year which has now drawn to a close will probably prove to be—when the returns are completed—even more productive in the matter of new ships than the previous year, which, it will be remembered, was marked by an unusually heavy output. It may even turn out to be the most productive on record in spite of the reiterated complaints about wilful loss of time by certain sections of the workmen. One fact is to be noted, that at no time throughout the year was there a dearth of work for builders at any of the centres. This, of course, is the first condition essential to the realisation of a large output; but along with it there have been several other circumstances that help to account for the remarkable increase in tonnage launched. The weather, which is not an unimportant factor in ship production has, on the whole, been favourable for the carrying on of outdoor work, and very little time has been lost in the shipyards through adverse meteorological conditions. The productive resources of most establishments in the country have been further increased by the putting down of new and improved machines, by the extended application of electrical power, and the further adoption of hydraulic and pneumatic riveting systems. It is consequently not to be wondered at that an unprecedentedly big output has been attained. whilst had it not been for the wilful abstention of workmen at all the centres, and the absolute insufficiency in number of one particular set of men, the output would undoubtedly have been much larger. The men referred to are the riveters, and it is not too much to say that every shipbuilding firm in the country have been more or less retarded in their operations through the want of sufficient labour in this branch of the trade. Time after time firms have applied to the executive of the Boilermakers', and Ironshipbuilders' Society for men, but the executive was unable to supply them. Under these circumstances builders might have made an effort to supply themselves; for, after all, riveting, which only involves the repetition of the same operation a great number of times, cannot be looked upon as a skilled trade. The "operation" is simplicity itself, and the man who could not learn to do it satisfactorily in a couple of weeks would not be good for much. Amongst the commonly called "unskilled" workers of the country, there was ample material for builders to select from, if they were so minded, and why they did not resort to this expedient in their difficulties can only be accounted for on the ground of unwillingness to risk giving offence to the officials of the union. It is perfectly well understood that the Boilermakers' Union, which had on more than one occasion to admit its inability to supply men, would not sanction the introduction of non-society men to the work of riveting. In this respect, they furnish a notable example of that aggravatingly obstructive policy which consists in preventing the fulfilment of a legitimate demand by illegitimate means. It was, as we have indicated, quite within the power of the shipbuilders to supply their own requirements if they had so chosen, and it is still within their power, if they care to act independently of the Boilermakers' Union. Having reason to believe, however, that the great majority of builders desire the continuance of pacific relations between themselves and the workmen's organisations, we do not expect that the expedient of employing non-union men, and teaching them to close rivets, will be largely adopted yet awhile; but the further development of machine riveting is a matter in which there is less danger of hurting the susceptibilities of trade unionists, and it is in this direction that we expect the employers will find a way out of their difficulty in connection with the execution of riveting work.

The returns of Tyne shipbuilding to hand show that Messrs. Palmer turned out 42,683 tons, including two torpedo-destroyers, and two cargo steamers capable of carrying over 10,000 tons each. It is remarkable that the firm's output, exclusive of the two torpedo-destroyers, comprised only five vessels, the aggregate tonnage of which, however, approximated to 42,000 tons, giving an average carrying capacity of over 8,000 tons each.

Messrs. C. S. Swan & Hunter have very nearly equalled the Palmer Co.'s output, the figures being 42,522 tons. Seven vessels went to make up the figures in the latter case, the smallest of which was the *Newholm*, of 2,534 tons capacity, and the largest, the *Ivernia*, having a carrying power equalling 15,512 tons, with an indicated propelling power equivalent to 12,000 H.P. This vessel was built to the order of the Cunard Co., and is without doubt one of the finest specimens of naval architecture afloat. The launching of such a vessel is enough to make the year a record one for the Tyne; for, though its yards have turned out many very superior merchant vessels in the last quarter of the century, never before has there been seen on the river, as one of its products, a vessel of such carrying and steaming capabilities as this. Besides making this notable contribution to the list of Atlantic liners, the firm have this year signalised their efforts by another achievement, namely, the reconstruction of the s.s. *Milwaukee*. This feat has attracted world-wide attention, and it is unnecessary to repeat here details that have been recounted many times and in many quarters already. This we may say, however, that it was a feat which was never before attempted or accomplished, and is not likely to be often repeated.

Messrs. John Redhead & Sons have built eight vessels aggregating a tonnage of 27,133 and have also constructed the machinery and boilers for them. In the graving dock department the firm have been well employed during the year, and in the time have had many important repair contracts through their hands.

The new firm which only commenced business towards the autumn of 1897, and which is known as the Northumberland Shipbuilding Co., Limited, have done remarkably well this year, outdistancing many of the older firms in the matter of tonnage launched. They have put off the stocks six vessels, all of which, excepting one, are of tolerably large tonnage, the aggregate capacity amounting to the respectable figure of 20,330 tons. This firm, like others, suffered from an inadequate supply of labour in the riveting department, and the output attained under the circumstances speaks volumes for the smartness of the management.

Messrs. Wood, Skinner & Co. launched eight vessels, but most of them were of comparatively small tonnage, accounting for the fact that the output only reached a little over 11,000 tons. The firm are understood to be well supplied with orders for next year (for vessels of a heavier class) and will doubtless be able to show a larger production at the end of 1900.

The activity of the Smith's Dock Co. (late Edwards Brothers) may be noted in that they launched during the twelve months no fewer than 23 vessels. These were all of a small class, aggregating no more than 4,432 tons; but when it is recollected that the company have completed an average number of repair contracts during the year, it will not be difficult to realise the high state of briskness that must have existed throughout.

Messrs. Dobson and Messrs. R. Stephenson & Co. come very near each other in the matter of output, the figures being 13,262 and 12,601 respectively. We do not hear of any reports regarding new developments in the case of the former firm; but with reference to the latter, a change has been effected in the constitution of the company, which is but the forerunner of other changes of an interesting and important character. Among these may be mentioned the utilisation of part of the yard area for the construction of a large graving dock, a rearrangement of the building berths, and the putting down of additional plant, which will probably include an installation of electrical machinery for lighting and power transmission.

The returns of Messrs. Armstrong, Whitworth & Co., Messrs. Wigham, Richardson & Co., Messrs. Hawthorn, Leslie & Co., and the Tyne Shipbuilding Co. are not before us; but we know they must have reached a satisfactory figure in each case, as all of them have been as busy as possible throughout the year. Messrs. Richardson launched on the 16th inst. their last vessel for the year. This was the s.s. *Schwarzenfels*, ordered by the Hansa Co., of Bremen. This German company are old customers of the firm and have been supplied by them with many fine vessels during the past two decades. It would seem that notwithstanding the rapid development of shipbuilding in Germany, there are owners in that country who still prefer to get their ships from English builders, which circumstance seems to be a proof of their belief in the superiority of English work. In other departments of industry, the soundness of British work, as compared with that done in other countries, is undisputed, and we have every confidence that this country will continue to maintain the lead in shipbuilding—both as regards quantity and quality—which has so long been held.

The Tyne Shipbuilding Co. have turned out some very fine steamers during the year, and, as their resources have been very considerably augmented, it is but reasonable to expect that their operations in the future will be conducted on a more extended scale.

Engineering.—The North-Eastern Marine Engineering Co., Wallsend, have supplied machinery to a large number of vessels during the year, and are now provided with sufficient orders to secure the establishment against slackness for nearly a couple of years. The Wallsend Slipway Co. have also had a successful year, amongst the vessels engined in the time being the big *Ivernia* and one or two others of a specially important class. The St. Peter's Engine Works are still running night and day, and the engineering department at the Palmer Co.'s works is amply provided with orders. The Neptune Works, Low Walker, are also very busy, and at the Elswick Ordnance Factory the pressure of work is quite unprecedented. Locomotive works at Newcastle are kept going briskly, and at the Felling Machine Tool Works (Messrs. Noble & Lund) the orders in hand are numerous and important. The firm's output in 1899 has considerably exceeded that of former years, and has comprised not only band-saws of the special type for which they are noted (used for cutting iron and steel cold), but also piston rings, lathes, and other machines for shipbuilding and engineering works.

Messrs. H. Watson & Sons, of the High Bridge Works, Newcastle, have been exceedingly busy throughout the year, the result being that in the various departments a highly satisfactory output is shown. The firm's "Atlas Manganese Bronze" has come into great repute as a material for propellers, and it is now being largely used. Their "Westminster" feed and ballast pumps are also in great demand, being found both economical and effective. The firm are also doing a good business with the feed-water filters which they have patented, and are now manufacturing on a large scale. These filters are said to have a larger filtering area than any other type of marine filter in use, proportionately, of course, to weight, space, and I.H.P., and they are being largely adopted for war, cargo, and passenger vessels.

Messrs. Clark, Chapman & Co. have had an exceptionally large output of windlasses, steam winches, donkey boilers, &c., during the past year, and all the departments continue to be well supplied with orders. In the electrical departments business is also brisk, and a number of ship-lighting contracts are in progress.

Messrs. Crosier, Stephens & Co, engineers and machinery merchants, of 2, Collingwood Street, have done remarkably well this year, and succeeded in further developing a demand for all the principal specialities with which they are connected in a representative sense. Amongst these may be mentioned the Meldrum furnace, whose fame as a fuel economiser has now become world-wide. A number of these furnaces were installed at Tyne Dock some time ago, and have given excellent results, and we now hear that some important local orders are being negotiated.

The Holzapfel's Compositions Co., Limited, have, we understand. had an exceptionally prosperous year in the sale of their well-known anti-fouling paint for ships' bottoms, and "Lagoline" paints for general use on shipboard. The latter are quick-drying and non-explosive, and present an appearance similar to enamel or varnished paint. The Zynkara Co. have turned out large quantities of their speciality during the year, both for home consumption and exportation, and their productive resources continue to be fully utilised in meeting the requirements of customers.

Mr. W. F. Snowdon, of 32, Side, Newcastle, has been exceedingly busy throughout the year, and has had the contracts for covering with non-conducting material the boilers of the following steamers, amongst others:—The *St. Leonards*, the *St. Andrew*, the *Kent*, the *Lucilene*, the *Manchester Importer* and the *Manchester Shipper* the *Surrey*, the *Saxoline*, the *Armand*, the *Karamea*, the *Cookham*, and the *St. Dunstan*. All of these were vessels of large size, some of them being oil-carrying steamers, whilst others are to be engaged in the colonial meat trade. Snowdon's patent removable mattresses for ships' boilers are, it may stated, in great demand.

Blyth.—The Blyth Shipbuilding Co. have increased their output in 1899, as compared with 1898, by 4,589 tons, their total for the year just closed being 10,663 tons. The company have carried out in addition a large number of important repair contracts in the graving docks connected with the yard, and their prospects for the coming year, both in new and old work, are excellent. The Blyth Dry Dock Co. are also, it is understood, having a good prospect for the last year of the century.

THE WEAR.

(*From our own Correspondent.*)

Shipbuilding.—The output of tonnage on the Wear during the past twelve months forms a record, the figure being 268,508 tons. This is the largest output yet reached, the highest previous total being 259,450 tons in 1898.

Messrs. J. L. Thompson & Sons again take the leading place with the large total of 36,013 tons, Sir James Laing coming next with 34,384 tons, and Messrs. Short Brothers third with 30,080 tons. The output of the last-named firm is especially creditable, seeing that they were obliged, early in the summer, to completely reorganise their riveting staff. The desertion of practically the whole of their old staff of riveters at the instigation of certain trade union officials is now an old story, and it is only referred to here for the purpose of showing how very possible it is for shipbuilding and other firms to carry on business without being subjected to trade union dictation. Messrs. Doxford are the fourth on the list, and are not very far behind Messrs. Short Brothers, their figure being 29,543 tons, the Sunderland Shipbuilding Co. being next in order of precedence with 26,163 tons. The output returns of the remaining eight firms range from a little under 4,000 to a little over 20,000 tons, and all excepting two show increases upon the preceding year. Reverting to the leading firm, Messrs. J. L. Thompson & Sons, it was a striking fact, and one very much to the firm's credit, that nearly all vessels launched by them during the year were for former customers, and to some of whom the firm have supplied as many as seventeen vessels previously. This fact speaks for itself, and scarcely requires comment. It may be stated that electricity has been extensively adopted as the motive power at this establishment, steam being to a large extent discarded. The firm have concentrated the frame-making branch by erecting additional sheds on new ground recently acquired, and this arrangement, it is expected, will further facilitate productive work.

It is reported that further alterations are to be carried out at the establishment of Sir James Laing & Sons, involving amongst other changes the turning of the building berths in the "high yard," to launch up the river (westwards) instead of down (eastwards) as at present. It is understood that the area of the yard will be further extended. The firm have at present a vessel in their Deptford graving dock undergoing alterations to fit her for the conveyance of military stores to South Africa.

Messrs. Priestman & Co. have added two berths to their yard, in either of which vessels of the largest class can be laid down. The largest yet built on the new ground is the s.s. *Granada*, 411 ft. long; but it is stated that there is one now on the stocks 446 ft. long. Messrs. Pickersgill have also carried out great improvements during the past year, and will soon, it is understood, have one or two additional building berths available.

A fair amount of repairing work has been executed on the Wear during the year, Messrs. Austin & Sons having had a very large proportion of the work placed. An alteration contract, involving the lengthening of a steamer by the addition of 20 ft. of new structure amidships, was carried out at Messrs. R. Thompson & Son's Bridge Dock in a remarkably short time, considering the difficult nature of the work.

Engineering.—Messrs. John Dickinson & Sons engined 16 vessels during the year, all of which were built at local yards. The aggregate I.H.P. amounted to 29,004. Messrs. George Clark, Limited, engined 24 vessels, all of which were also built at local yards, and the machinery of which aggregated 7,281 N.H.P. The North-Eastern Marine Engineering Co. fitted 20 vessels with machinery, the aggregate power of which was 27,575 I.H.P.; and Messrs. Doxford engined seven vessels (all built by themselves), the total power of which amounted to 20,870 I.H.P. Messrs. W. Allan & Co. turned out 12,900 I.H.P. for eight vessels, and Messrs. MacColl &Pollock 3,950 for 11 vessels. The latter firm, it may be stated, have been commissioned to supply the engines and boilers for a 3,000-ton boat recently ordered from Messrs. Harkess & Sons, Middlesbrough. We understand that Messrs. Mail & McFarlane, engineers and ship repairers, Tyne Dock, have, in conjunction with two Sunderland firms, acquired possession of graving docks, &c., at South Shields, and will enter on active proprietorship at the opening of the year.

The Hartlepools.—The returns of output at the shipbuilding establishments of Messrs, W. Gray & Co. show a total of 27 vessels launched, having an aggregate carrying capacity of 77,501 tons. This constitutes a record, the firm's previous highest total being 72,323 tons last year. The other Hartlepool firms have also a large output, and all of them have excellent prospects for next year. In the engineering establishments business remains brisk, and other local industries are fairly prosperous.

Stockton.—The output of tonnage at this active centre is quite up to the best records of previous years, and all the firms being well supplied with orders, a continuance of briskness over next year is looked forward to. The prospect for engineering firms is also excellent, and both bridge and boiler-making works are certain of, at least, another twelvemonths' run of activity.

Middlesbro'.—Sir Raylton Dixon & Co. have had an exceptionally large output in 1899, amongst the vessels launched being several of a superior class. Messrs. Craggs & Sons have also done well, and are understood to have some good orders for delivery next year. In the steelworks great activity continues to exist, and a very large output is maintained. Prices still show a tendency to rise. Bridge builders are busy, and in both boiler works and foundries great activity is maintained.

Darlington.—The Darlington Forge Co. continue fully employed in all departments, and have many important contracts in hand.

THE MERSEY.

(*From our own Correspondent.*)

THROUGHOUT all sections of industry connected with the engineering, iron, and coal trades of this district, the past twelve months has been a period of prosperity that for a very considerable time past has had no precedent. In fact, as far as the iron trade is concerned prices for some descriptions of material have not touched so high a point for the last twenty-four years, and the activity as regards both the using and the producing branches of the industry has more than fully taxed the resources of engineering establishments, pig and finished iron works, and collieries.

The various engineering industries have fully maintained the exceptional activity which characterised the greater part of the preceding year. In practically all the leading branches establishments have been exceedingly pressed with work with the new orders coming forward, in most cases sufficient to more than take the place of those running out, and to ensure full employment well over the ensuing year. The shipbuilding industry on the Mersey has, however, during the last few years, from various causes, been steadily on the decline—a fact to which reference has previously been made in these columns—and Messrs. Laird Brothers, of Birkenhead, now represent the only shipbuilding yard of importance remaining. This firm has, however, been exceedingly busy, and the following are the returns of the principal work turned out:—The *Glory*, steel twin-screw, 8,000 gross tons register, triple-expansion engines, 13,500 I.H.P., speed 17½ knots, for British Government; *Mabel Grace*, steel paddle, 1,314 gross tons register, compound engines 5,500 I.H.P., speed 20¼ knots, for British owners; *Som*, steel twin-screw, 320 gross tons register, triple-expansion engines, 6,000 I.P.H., 30 knots, for foreign owners. Machine tool makers, who commenced the year with work in hand to carry them over the bulk of the twelve months, have been extremely busy both in the light and heavy departments, a good deal of the work turned out having been for ordnance and marine engineering requirements, and the principal firms have had to refuse a considerable weight of new orders owing to their inability to promise anything like early delivery. Towards the close there has been a slight falling off in new work, but no real slackening of activity on orders in hand. Heavy stationary engine builders have also been fully engaged, but throughout the year there has been a decrease in the amount of new work given out, which has scarcely been adequate to replace the old contracts completed. In the boiler-making trade the position has been one of remarkable activity; in fact, establishments in many cases have had more work in hand than at any previous period, and generally close the year with orders on their books sufficient to carry them well over the ensuing twelve months, a large amount of work having been recently secured in connection with electrical power and other developments in the district. In the locomotive building trade much the same exceptional briskness has prevailed. During the year a number of important contracts have been on the market in connection with railways both at home and abroad, and establishments in this district are well booked for some time ahead. Perhaps the most prosperous branch has been that of electrical engineering. Establishments have been kept going to their utmost capacity, the enormous developments of electricity, both for lighting and for power, bringing forward an unprecedented pressure of work in this department, and the new orders offering have been altogether beyond the present capacity of electrical engineers for anything like early execution, and the year closes with no falling off whatever in the exceptional activity that has been experienced all through the twelve months. In connection with hydraulic engineering, bridge building, and general constructive work, exceeding briskness has also prevailed. The textile machine trade, although very fully engaged during the greater part of the year, has towards the close shown a falling off as regards new work coming forward in some branches. Speaking generally, engineering establishments close the year with orders in hand sufficient to keep them well employed for some time ahead, and with new work coming forward freely. The exceptional activity of trade has been fully reflected in the employment returns of workmen's unions, the number of unemployed members having fallen to a lower average than has been recorded for nine or ten years past. The percentage of unemployed has ranged from about 2 to 2½ per cent. in the Amalgamated Society of Engineers, 1 per cent. in the United Machine Workers' Association, and practically "nil" in the Steam Engine Makers' Society. With regard to any labour matters that have cropped up, these have mostly been settled by amicable arrangement between the employers and the workmen. The chief question dealt with has been the demand for a 2s. advance in wages made by the operatives in the Mid-Lancashire district early in the year. This was ultimately submitted to arbitration, with the result that an advance of 1s. per week was conceded. It may be added that during the past month the representatives of the Amalgamated Society of Engineers in Liverpool have, after meeting the local employers' association, arranged for the full acceptance of the trial trip terms offered by the employers' federation in 1897, which are regarded as considerably better than those previously in vogue at the above port.

In the iron trade the upward move in prices which took place in 1898 has been not only fully maintained, but greatly exceeded during the past 12 months. The upward move during 1899 has averaged 25s. to 27s., and even with this great rise business has been offering in excess of what makers could entertain. The year opened with a strong, healthy tone prevailing, and prices tending to harden, quotations averaging 53s. 6d. less 2½ for foundry Lancashire; 51s. 6d. net for Lincolnshire; 53s. 6d. to 55s. for Derbyshire; and 53s. 4d. to 53s. 10d. for Middlesbrough, by rail Manchester; Eglington, 55s. 6d.; Glengarnock, 55s. to 55s. 3d.; Manchester Docks, and forge qualities, delivered Warrington, 47s. 6d. to 48s. less 2½ for Lancashire, and 47s. to 47s. 6d. net for Lincolnshire. During January there was a persistent upward move in prices, especially for forge qualities. This was followed by some unsettlement in the market, owing to speculative operations in warrants. Large users were mostly well covered, and held back from buying in any quantity, but with makers correspondingly oversold, and consumers taking full deliveries under contract, there was no pressure to sell. With the commencement of the second quarter there was a gradual return of more active buying, and makers sold so heavily that some brands were practically withdrawn from the market. A strong upward move in prices set in, and successive advances during April brought the basis to 55s. 6d. to 56s. 6d. net for Lincolnshire foundry; 58s. for Derbyshire, with Middlesbrough, 63s. 4d. to 64s. 6d. net by rail Manchester, Lancashire makers not quoting at all; and Scotch iron, 67s. to 68s. Manchester Docks, with Lincolnshire forge, delivered Warrington, 54s. 2d. to 55s. 2d. American pig iron, which had by coming forward in fair quantities early in the year, ceased to become a factor in the market, stocks in this district being practically cleared off, with deliveries not coming forward on account of contracts placed in the States. American pig iron rose from about 50s. at the beginning of the year to 58s. 6d. and 60s. Manchester Docks, with only small quantities obtainable. With the increasing scarcity of the principal brands there was a further rise in prices during the next three months, Lancashire foundry getting to 77s. 6d. less 2½; Lincolnshire, 75s. 6d. net; and Derbyshire, 77s. 6d. to 80s.; Middlesbrough, 84s. by rail Manchester; Scotch iron, 78s. to 78s. 6d.; with American pig iron, 74s. for October delivery, Manchester Docks; and forge qualities, 73s. 2d. net for Lincolnshire, delivered Warrington; with Lancashire makers unable to quote. Early in August, however, an extraordinary collapse in warrants disorganised the market. In Scotch and Middlesbrough brands there was a big fall in prices in the open market, and generally there was an indisposition to operate. Makers did not follow the extraordinary drop in warrants, but they were considerably underquoted by merchants and dealers, and gradually had to back down from some of the high prices that had been quoted, although Lancashire makers still held to about their old rates. Business continued unsettled, buying being restricted to very small quantities, with merchants persistently underselling makers even at the reduced rates, until towards the end of October, when buying again became brisk, and prices quickly recovered, quotations with the close of the ensuing month getting to 79s. 6d less 2½ for Lancashire foundry; 76s. 6d. net for Lincolnshire; 80s. to 82s. 6d. for Derbyshire; 79s. 4d. to 80s. 4d. for Middlesbrough, by rail Manchester; Scotch iron 82s. 6d. to 83s, Manchester Docks; forge Lancashire 77s. less 2½, and Lincolnshire 75s. 2d. net, delivered Warrington. The closing weeks of the year brought about a somewhat less satisfactory position, owing doubtless partly to dearer money and partly to the depressing effect of the South African outlook. The chief effect has been in the depreciation of speculative brands, which has caused some easing down in makers' quotations, both for Middlesbrough and Scotch iron, and this has tended somewhat to weaken both local and district brands, owing to the curtailment of buying, and underselling by merchants in the open market. The present quotations may be given about as under—Lancashire foundry, 79s. 6d. less 2½; Lincolnshire, 76s. to 76s. 6d. net; Derbyshire, 78s. 6d. to 80s.; Middlesbrough 78s. 4d. to 79s. 4d., by rail, Manchester; Scotch iron, 81s. 6d., Manchester Docks; forge Lancashire, 77s. less 2½, and Lincolnshire 75s. 2d. net, delivered Warrington.

The upward move in finished iron has been even stronger than in raw material, and at no previous period have makers been more pressed to meet the requirements of the market. Prices have advanced about £3 per ton all round, and this has had apparently no appreciable effect in restricting buying. In January prices were £6 10s. to £6 12s. 6d. for Lancashire bars, but were almost immediately raised to £6 15s.; sheets averaged £7 5s.; and hoops £7 to £7 5s., delivered Manchester. For a while makers were very cautious about putting up their prices owing to the keenness of foreign competition, but early in the second quarter a general advance of 5s. was put on both bars and hoops, and sheets also stiffened up to some extent. With an increasing enquiry coming forward all round, and a difficulty in obtaining supplies of raw material, makers were cautious about booking beyond comparatively small quantities, and the continued pressure of demand brought forward rapid successive advances during the next three months, bars being put up 5s. in May, 10s. in June, and 10s. in July, with a similar advance in sheets and hoops. Notwithstanding these advances there was no decrease in the weight of new work coming forward, whilst there was an almost entire disappearance of both American and Continental competition, the United States in fact becoming considerable buyers of hoops in this country—a trade which had for years past been completely taken away from Lancashire, whilst in the wire rod trade American manufacturers withdrew altogether from the market, and Lancashire makers had no difficulty in filling their books with orders at £9 to £9 5s. f.o.b., Liverpool. No effect was produced by the speculative fluctuations in warrants except perhaps that there was a temporary check on buying. In face of a tendency rather to weakness than otherwise in raw material, there seemed to be no check to the continued strong upward move in manufactured material. A number of successive advances took place in bars, which brought the basis at the end of November to £9 10s., whilst sheets during the same period rose to £11, and hoops £9 17s. 6d. to £10 2s. 6d. These heavy advances tended for the time to restrict buying, but makers have closed the year so well sold into 1900 that they are quite indifferent about booking fresh business, and the temporary limitation of trade has had no effect whatever in weakening prices.

The year opened in the steel trade with a continuance of the pressing demand which had set in during 1898, and, with an exceedingly strong outlook, both makers and manufacturers were exceedingly chary about giving quotations for anything like forward delivery. With regard to hematites as the year advanced, the increasing requirements of consumers steadily forced up prices; and, although for a time they seemed to lag rather behind pig iron, this was fully made up by the rapid upward move during the second half of the year, and the advance during the twelve months has been about 25s. per ton. The collapse in warrants in August brought about some temporary retrograde movement, with merchants and dealers pushing sales at considerably under makers' prices; but the market quickly recovered, and before the close of the year makers' quotations had risen from about 65s. 6d. to 67s., and 67s. 6d. less 2½ in January to 90s. 6d. to 93s. less 2½ delivered Manchester. Billets during the year have advanced from £4 15s. net to £7 10s., bars from £7 for common and £7 12s. 6d. to £7 15s. for better qualities to £9 for common up to £9 15s. for better descriptions. Common steel plates have risen from £7 17s. 6d. to £9 2s. 6d. and £9 5s., and boiler plates from £8 10s. to £8 12s. 6d. in January to £9 10s. to £9 15s. in December, delivered Manchester district. The position all through the year has been one of exceeding activity, and although with the close there is, perhaps, a somewhat lessened pressure, works here and there, although heavily sold, being short of specifications from customers, and consequently rather lower sellers, it can scarcely be said there is any real weakening in the general outlook.

The general upward move in prices has been fully shared by the coal trade, and for all descriptions of fuel for iron-making and general manufacturing requirements there has been an exceptional pressure of demand, which has more than taxed all the resources of the collieries. House-fire qualities, business in which is largely governed by the seasons of the year and weather conditions, have scarcely met with a full average demand, but prices for these were, perforce, influenced by the strong upward move in other descriptions of fuel. The lower qualities of round coal have been in active demand all through the year for steam and forge requirements, and the whole output of the collieries has generally moved away, with a steady hardening in prices. The most noticeable feature, however, was the exceptional position of engine fuel. The output of slack was not quite up to the average, owing to the limited demand for house-fire coal; whilst, on the other hand, requirements for consumption showed a very large increase. The result was a general shortness of supplies and a strong upward movement in prices, representing an advance of about 75 per cent. during the 12 months and 125 per cent. on previous minimum rates. The following comparison of prices will show the advance that took place during the year:—Opening prices: Best Wigan Arley, 12s. to 12s. 6d.; Pemberton 4 ft. and seconds Arley, 10s. 6d. to 11s.; common round coal, 8s. 6d. to 9s. 6d.; common slack, 4s. 6d.; medium, 5s. to 5s. 6d.; best sorts, 6s. to 6s. 6d. at the pit. Present rates: Best Wigan Arley, 13s. 4d. to 13s. 10d.; Pemberton 4 ft. and seconds Arley, 11s. 8d. to 12s. 6d.; common round coal, 10s. 6d. to 11s.; common slack, 7s. 6d.; medium, 8s. to 8s. 6d.; best sorts, 9s. to 9s. 6d. On gas-coal contracts local collieries have obtained an advance of 1s. 6d. to 2s. over the 1898 prices, the rates at which these were settled being about 9s. to 9s. 3d. for the lower qualities and 9s. 6d. to 10s. for the better descriptions, as against 6s. 9d. to 7s. and 7s. 9d. to 8s. at the pit the previous year. For locomotive fuel railway companies had to settle their contracts on a minimum basis of 8s., as compared with 6s. 6d. per ton in 1898; whilst any quantities which had to be purchased later on could only be bought at 2s. above the previous year's prices. On coke, the production of which was, of course, largely affected by the scarcity of slack, and for which there was an exceptionally large demand both for furnace and foundry purposes, prices rose about 8s. per ton during the year, furnace sorts advancing from 14s. up to 22s. and foundry sorts from 20s. up to 28s. at the ovens.

The shipping trade fluctuated somewhat during the year, but with lessened supplies offering at the Mersey ports, owing to the brisk inland demand for steam coal, prices went on steadily, hardening from about 9s. 6d. at the commencement to 12s. and 12s. 6d. as the average prices at the close for steam coal delivered Mersey ports or Manchester Ship Canal.

THAMES.

(From our own Correspondent.)

THERE is considerable danger in the use of Thames water in boilers in consequence of a deposit of mineral salts on furnace crowns. Mr. Stromeyer points out that formerly the drinking water which was taken from the Thames after contamination with sewage, but not with sea water, was again discharged into the river and kept back the sea water. Now the sewage is carried further away and mixed at once with the sea water, and does not exert the same influence. Now the Thames water is much more brackish, and boilers which for years past have been fed with Thames water without giving trouble sometimes suffer from collapsed furnaces and excessive corrosion traceable to an excess of sea water. The remedy is to test with a salinometer daily.

Griffin Launch Engine.—This engine is like the ordinary marine engine of the nautical type and it has two cylinders with one crosshead and connecting rod. This arrangement of cylinders allows an impulse to be given every revolution. There is another novelty in the engine for producing the reversing of the motion of the boat. This is usually done by means of gearing on the shaft, which allows the engine to run in the same direction all the time. In the Griffin engine right and left handed screws are used. The crank shaft is coupled to either and the other is left free. The propeller nearest the boat is mounted in a hollow shaft outside the shaft of the other propeller. The starting-wheel of this propeller is connected to its shaft by a clutch, and can be let loose when not required. When loose it is moved until it goes very quickly and then flung into gear with the shaft, when its stored energy is depended on for causing the engine to make a few revolutions when a charge is drawn in and the engine begins work, and then acts automatically. The vaporiser is so constructed that low temperatures only are used for vaporising the oil. This avoids distillation, which leaves a tarry product which the engine cannot deal with. An air blast is first applied to atomise it, and divide it into small particles, and as these move they are brought in contact with hot air. The oil is not brought into contact with hot metallic surfaces, but depends more on the radiation of heat from the exhaust gases after they have left the cylinder heating those radiating surfaces. Even a little of the exhaust gases are allowed to mix with the charge to prevent it from acting too quickly and exploding too suddenly. The admission of exhaust gas can be regulated, and the effect of the action is easily distinguished in the sound of the explosion. The vaporiser is attached to the side of the cylinder. There are two pumps, one for giving air pressure, the other water circulation. The air pressure is about 10 lbs. per square inch in the reservoir in the bed of the engine. This air, sent through the sprayer, atomises the oil, and prepares it to enter the vaporiser to be heated. The vaporiser is heated on the outside with the exhaust gases. The engine is governed by varying the admission of air to the sprayer, and the explosion is entirely stopped by cutting off the air when no oil is sent into the vaporiser.

Boiler Feed Pump.—This is a direct-acting pump, with a compound tandem engine. The high pressure cylinder is 7½ in., and the low-pressure 12 in. The valves are balanced and actuated by steam. There is a cataract cylinder for machinery; the action of the valves silent; the stroke is 10½ in.; the pumps are the design of Mr. J. P. Hull.

The East London Association of Foremen Marine Engineers met at the London Tavern, when Mr. J. T. Milton, of Lloyd's Register, presided. The chairman said the association was founded mainly for the mutual improvement of its members in the knowledge of engineering. They knew how when a lot of engineers met they always talked "shop," and an association like this, when it should come together to discuss papers, was sure to lead to the spread of a good deal of valuable information. It was not given to everyone to know everything, and the beauty of an institution of this kind was that the members were communicative and generous, each being happy to supply the other with statements as to the results of his practical experience.

There was another advantage which arose from an institution of this kind. Enormous advances were made, because each generation began where their forefathers left off—the younger men commenced with the knowledge with which the older men were leaving off. There was another advantage. The foreman formed a valuable link between masters and men, and if he was worth his salt he was the friend of both master and men. There was a time when the finest ship in the world did not belong to the British nation, but to-day we possessed the wonderful ship *Oceanic*. Mr. John Kennedy said the marine engineering trade was never in a more prosperous condition. Every engineering yard in the country was full of work. A director of one of the largest firms in the North-East of England told him not long ago that he had 78 pairs of marine engines on his books, which meant that they would not take more contracts for 12 months. Mr. H. A. B. Cole said the Briton, whether he came from Cornwall, the Clyde, or Ratcliff Highway, could be trusted more than the workman engineer of any other country. He could be more trusted to go into dark holes and to do his duty without anyone to look after him.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—There is not much that is new to report about the shipbuilding and marine engineering trades of Barrow this month. Unprecedented activity is evidenced at the great yard of Vickers, Sons & Maxim, at Barrow, and the orders in hand are being proceeded with very satisfactorily. The weather has been somewhat against out-door operations, and the shortness of the days in November reduced the number of hours which the platers and riveters could work, but the progress made has been very marked notwithstanding. The first-class cruiser *Hogue* for the Admiralty is receiving considerable attention, as are also the *Euryalus* and the *King Alfred*, but they will not be launched for some time after the *Hogue* is put into the water. There is a push noticeable in the construction of the Japanese battleship, and, although a couple of years must elapse before she can be delivered, the Japs are wanting her at the earliest practicable date. This battleship will be one of the largest ever built for any Power, and as she is a Barrow-designed ship, and will have Vickers armour plates for her protection, be mounted with Vickers guns, and driven by Barrow-designed and constructed engines, it is expected she will not only present many novelties but will prove a credit to her builders, to her owners, and to Mr. James Dunn, her designer. The torpedo-boat destroyer *Vixen*, for the British Admiralty, will be the first craft to be launched at the Barrow yard next year. Her hull is in frame and her plates are being fixed, whilst her engines are in a forward state of construction at the other side of the yard. Marine engineers are not only busy with the work of building the main and auxiliary engines for the several ships that are being built at Barrow, but they are full to overflowing with orders for gun-mounting for all the heavy guns built by Vickers at their Sheffield works. This new department at the Barrow yard has been enlarged twice since it was originally laid down, and now a third and very important enlargement has been decided on and the work commenced. The gun-mounting shop already contains a vast number of the highest class of machines of every sort required for this good class of work, and further new machinery has been ordered to efficiently equip the new portion now being built. Much delay in the completion of orders in hand has been caused by the non-delivery of machinery up to time, and this is likely to be a further source of annoyance in the future, as the engineering trade generally is so congested with orders that masters, generally speaking, are either unable to deliver machines as early as required or obliged to refuse orders altogether. The same fact applies to other departments of the Barrow yard, where work is being delayed in consequence, but every day brings the works more and more up to an efficient point in every department; and certainly, when the whole and complete scheme of enlargement is completed, Messrs. Vickers will not only be able to undertake a much fuller programme of work but ensure smarter delivery than is possible under conditions such as those existing at present when the firm have very big orders in hand, all of which are needed for the earliest possible delivery. The completion of H.M. battleship *Vengeance* is proceeding very satisfactorily. Her engines have been fitted in their places and her boilers fixed. One of her masts has been stepped, and good progress has been made with all her auxiliary machinery and appliances. She will be completed in the autumn of this year and will be the first battleship ever produced by a single firm, absolutely from its own resources, for the ship will be built, engined, fitted with guns, and protected with armoured plates, all produced by Vickers at their Sheffield, their Barrow, and their other works. This is a very big thing to say, and it certainly is a feather in in the cap of the Sheffield-Barrow firm. The workmen of Messrs. Vickers who are housed on the s.s. *Alaska* have increased in number since the management of the vessel has been placed in their own hands. They work it on the co-operative system, and provide good food, clean and comfortable berths, washing, mending of clothes, and all the domestic comforts and more than are to be found in ordinary lodgings. The famous liner has become a very popular home, and is serving a most admirable purpose until Messrs Vickers, or the builders and contractors of Barrow, provide a large number of new houses. These are very badly needed, and over and above the 1,000 new houses which are being built by Messrs. Vickers on Walney Island, there is need for a still further increase in the number of houses in the town of Barrow itself; for not only are there great developments in progress at Messrs. Vickers works, but at other works in the town, and to a great extent one is the cause of the other. It is evident that for many years to come Barrow will need an ever-increasing number of houses for the accommodation of workmen. At present this fact is very injurious to Barrow trade,as it is checking enterprise which it is desirable should proceed. Many workmen desirous of living in Barrow are deterred from doing so by reason of the scarcity of house accommodation. From a climatic point of view Barrow is admittedly one of the finest towns in England. It is surrounded on three sides by the sea, and is built at the nose end of a peninsula. It is healthy beyond measure, because it is a new town, and has been laid out on modern principles, with good broad, open thoroughfares, the principal ones having trees planted both sides, and with a most perfect sanitary system. The death-rate is low and the physique of the people high. Those who have lived in the place for some time are slow to go elsewhere, and are always ready to come back. The demand for new shipping tonnage is very steady and brisk, and there are several important contracts in the market, but local builders generally have their hands so well filled that they cannot at present undertake any new business which requires early attention.

West Cumberland.—There is great steadiness in the West Cumberland shipbuilding industry, and the yards at Workington and Maryport are very fully employed on light craft, generally speaking, for which there is a very good demand. Builders have no difficulty in getting orders, but they are careful not to overstock themselves in this respect. Their prospects are good, and under present conditions it is reasonable to believe that their profits afford a fair margin on the capital invested.

Shipbuilding Material.—There is a very full demand for all sorts of shipbuilding material, and the steelworks in this district are exceptionally well off for orders. There is a very full demand for both light and heavy plates. Orders are coming in freely and makers have been able to increase their prices. £8 per ton is the value of heavy plates of ordinary sections, and shipbuilders have no objection to this high figure; but the demand is so brisk that one is led to the belief that it is a reflex of the position of the shipbuilding trade itself, for, although very little new tonnage has been booked by shipbuilders in this district for some time past, they have plenty of orders to give out for material on new specifications. A very good enquiry is maintained for heavy steel castings, and the foundries are all busy night and day and are likely to remain so for a long time to come, as the demand in this department is not only for shipbuilding purposes but for marine engineering as well.

The Hematite Trade.—The hematite market remains very briskly employed. There is a full demand for Bessemer sorts, and both at the Bessemer and Siemens-Martin departments and local steelworks there is a great demand for the crude material in the shape of Bessemer iron. Prices are firm at 80s. per ton net f.o.b. for makers' iron, and warrant iron is at about 74s. per ton net cash sellers. Stocks of warrant iron have been reduced somewhat during the month, but they still total up to about 210,000 tons. From this stock much of the demand for pig iron which makers cannot at present supply will be drawn, and this will help prices to advance

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

St. Dunstan.—On November 18th there was launched at Wallsend-on-Tyne, for Messrs. Rankine, Gilmour & Co., Liverpool, a steel schooner-rigged steamer of about 4,240 tons gross, named the *St. Dunstan.*

Amesbury Abbey.—On November 20th there was launched at Selby, for the Abbey Steam Fishing Co., Limited, Grimsby, an iron steam ketch, named the *Amesbury Abbey.*

Oliver Cromwell.—On November 21st there was launched at Hull, for the Yorkshire Steam Fishing Co., Limited, Hull, an iron steam ketch, named the *Oliver Cromwell.*

Northlands.—On December 2nd Messrs. William Gray & Co., Limited, launched a handsome steel screw steamer which they have built to the order of Messrs. E. O. & Trevor S. Jones, of Cardiff. She will take Lloyd's highest class and is of the following dimensions, viz.:—Length, over all, 329 ft.; breadth, 46 ft.; and depth, 23 ft. 6 in. The deck erections consist of poop, bridge, and topgallant forecastle. A tasteful saloon and cabins for officers, &c., will be fitted in the poop, engineers' room on the bridge, and the crews' berths forward. The hull is built with deep bulb-angle frames, cellular double-bottom and aft peak tank for water ballast, deep hatchways, powerful steam winches, steam steering gear amidships, hand screw gear aft, patent donkey boiler, patent direct steam windlass, boats on beam overhead, grain divisions, stockless anchors, two masts with schooner rig, and a complete outfit for first-class cargo vessel. The Central Marine Engine Works of Messrs. William Gray & Co., Limited, supply triple-expansion engines, having cylinders 23 in., 36½ in. and 62 in. diameter with 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The ceremony of christening the steamer *Northlands* was gracefully performed by Mrs. Trevor Jones.

Zeeburg.—On December 2nd there was successfully launched from Messrs. Robert Thompson & Sons, Southwick Yard, an improved single-deck steamer, built to the order of the Stoomvaart Maatschappij "Amsterdam," of Amsterdam. Length, over all, 336 ft.; breadth, 48 ft. 6 in.; depth, moulded, 24 ft.; class 100 A1, three-deck rule, deep-frame principle; and is designed to carry a large cargo on a very light draught. The deck erections consists of cargo poop, bridge 102 ft. long, and topgallant forecastle for berthing of sailors and petty officers. The accommodation for captain, officers, and engineers is built in large spacious houses on top of the bridge deck leaving the entire bridge clear for cargo if required. Ample water ballast, in cellular double-bottom and peaks, for about 1,140 tons, the bottom being divided into eight compartments for trimming purposes. The deck machinery consists of six powerful steam winches for working the hatches, with double derricks and extra large donkey boiler for rapid loading and discharging of cargo—the steam steering-gear being placed at after end of engine-room and controlled by shafting from wheel on bridge. The engines having cylinders 24 in., 39 in., and 64 in., with 42 in. stroke, with very large boilers, are by the North-Eastern Marine Engineering Co., of Sunderland. During construction, ship and machinery have been personally superintended by Mr. W. Fenenga, of Amsterdam. As the vessel left the ways she was gracefully christened *Zeeburg* by Miss Tak van Poortvliet, sister of the managing owner, after which a large party of ladies and gentlemen proceeded to the offices of the builders, where the usual toasts were proposed and responded to.

August Leffler.—On December 2nd there was launched at Sunderland, from the yard of Messrs. Osbourne, Graham & Co., a screw steamer, specially designed for wood and general trades, to the order of the Aktiebolaget Orion, at Gothenburg, and built under the superintendence of Captain J. M. Dannberg, who will assume command when completed. The dimensions of the vessel are 275 ft. between perpendiculars, by 40 ft. 9 in. by 20 ft 6 in. moulded depth. She has been constructed on the deep-frame principle to Lloyd's highest classification, and has large space for water-ballast, and all latest improvements for rapid loading and discharging. The vessel was named *August Leffler* by Miss Dalman, daughter of the managing owner, Consul Dalman, senior partner of the firm of Messrs. August Leffler & Son, Gothenburg. After the launch the vessel was towed to the Palmer's Hill Engine Works, to be fitted with triple-expansion engines, having cylinders 20½ in., 33 in., and 54 in. in diameter, by 39 in. stroke.

Margaret.—On December 2nd there was launched by Messrs. John Readhead & Sons, from their shipbuilding yard, South Shields, a steamer built to the order of Messrs. Franz Rahtkens & Co., Middlesbrough, and is the largest Tees-owned vessel. Her principal dimensions are—Length, 353 ft.; breadth, 46 ft. 6 in.; and depth, 27 ft. 4 in.; and, whilst built to Lloyd's highest class, and under their special survey, both ship and engines are considerably in excess of their requirements. The vessel is supplied with iron longitudinal shifting boards throughout, except in way of hatches. She is rigged as a two-masted fore-and-aft schooner, with telescopic masts acting as ventilators, and is of the improved single-deck type, has cellular double bottom for water ballast. Poop and bridge amidships are arranged for stowage of cargo. A spacious saloon, with state and mess rooms, spare berths, &c., has been erected on the bridge, and officers and engineers are located in iron houses on the top of the bridge on each side of the engine casing. The topgallant forecastle contains the berths for seamen, firemen, and petty officers. Iron steering and chart houses are built on the top of the cabin, and a second bridge for the better look-out, with steering standard stretched across the former. Steam-steering gear is placed at the after end of the engine-room casing, and connected with both steering apparatus amidships, whilst a powerful screw gear finds place aft on the poop. For rapid loading and discharging an extra large donkey boiler, with 100 lbs. pressure, six hatches and six winches, with 13 derricks, have been provided. The engines and boilers, with all the latest improvements, have also been built by Messrs. Readhead. The cylinders are 24 in., 40 in., and 65 in. in diameter, with 45-in. stroke, and steam will be supplied by two large multitubular boilers working at 160 lbs. pressure. The vessel was named *Margaret* by Miss Rahtkens.

Manchester Merchant.—On December 2nd there was launched by Palmer's Shipbuilding and Iron Co. Limited, from their Jarrow Yard a finely-modelled steel screw cattle and cargo steamer built to the order of the Manchester Liners, Limited, of which Sir Christopher Furness is chairman. She is of the following dimensions, viz.:—Length, 467 ft. by 52 ft. beam, and 39 ft. depth. The engines are also being constructed by the Palmer's Co.; they are of the inverted triple-expansion type, having cylinders 30 in., 50 in. and 81½ in. by 54 in. stroke, steam being supplied by three double-ended boilers 14 ft. 6 in. diameter by 17 ft. 6 in. long, with a working pressure of 180 lbs. The vessel was named *Manchester Merchant* by Mrs. R. B. Stoker, wife of the managing director of the Manchester Liners, Limited.

City of Manchester.—On December 2nd there was launched at North Shields for Hull owners a steel steam ketch of about 189 tons, named the *City of Manchester.*

Hercules.—On December 2nd Messrs. R. Craggs & Sons launched at Middlesbrough the large cargo vessel *Hercules* to the order of Mr. John Lockie, of Newcastle, which is of the following dimensions:—Length, over all, 372 ft.; breadth, extreme, 48 ft.; and depth, moulded, 30 ft. 10 in., and designed to carry about 6,900 tons all told. This vessel has been built to the highest class under Lloyd's spar-deck rule. The machinery will be supplied by Messrs. Sir C. Furness, Westgarth & Co., Limited, of Middlesbrough, and will have cylinders 25 in., 40 in., and 68 in. in diameter, by 48-in. stroke, and steam will be supplied by three large single-ended boilers.

Rosalie.—On December 4th there was launched by the Northumberland Shipbuilding Co., Limited, at Howden-on-Tyne, a large steel spar-deck steamer, of 7,000 tons deadweight capacity, built to the order of Messrs. John Cory & Sons, Limited, Cardiff. This vessel is built to the highest class at Lloyd's, and is 370 ft. long by 48 ft. beam by 30 ft. 10 in. depth, moulded. The steamer was christened the *Rosalie* by Mrs. Rowland Hodge, the wife of the managing director. She will be fitted with the latest type of machinery, of 2,000 I.H.P., by the Wallsend Slipway and Engineering Co.

Battenhall.—On December 5th the screw steamer *Battenhall*, built for London account, was launched from the shipbuilding and repairing works of the Blyth Shipbuilding Co., Limited, of Blyth. The *Battenhall* is 259 ft. long, and is of the raised quarter-deck type, having cabin accommodation on the bridge. Her engines are of large size, and will be supplied by Messrs. MacColl & Pollock, of Sunderland. The naming of the steamer was gracefully performed by Miss Vera Vaughan, younger daughter of the chairman of the Blyth Shipbuilding Co., Limited.

Molopo.—On December 7th there was launched from the yard of Messrs. Earle's Shipbuilding and Engineering Co., a steam trawler built to the order of Messrs. Thomas Hamling & Co., Limited. The vessel is 125 ft. long, by 21 ft. 6 in. beam, by 11 ft. 3 in. moulded depth, and will be fitted with triple-compound engines, having cylinders 13 in., 22 in., and 36 in. by 24 in. stroke, working at 200 lbs. pressure, supplied with steam from a large steel boiler. Mr. Hamling's granddaughter, Miss Florence Hudson, undertook the launching ceremony, and named the vessel the *Molopo.*

Linnet and **Swallow.**—On December 14th, there was launched at Hull, from the yard of Earle's Shipbuilding and Engineering Co., two steam trawlers, built to the order of Messrs. Moody & Kelly, of Grimsby, for the Pioneer Steam Fishing Co., Limited. Their dimensions are: 118 ft. 9 in. (over all) by 21 ft. beam by 11 ft. 6 in. moulded depth. They will be fitted with triple-expansion engines, supplied with steam from a large steel boiler, working at 200 lbs. pressure. The launching ceremony was undertaken by the Misses Lily and Olive Bryant, who named the vessels *Linnet* and *Swallow* respectively.

London Bridge.—On December 15th Messrs. Ropner & Son, of Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 325 ft.; breadth, extreme, 48 ft.; depth, moulded, 24 ft. 3 in. The steamer has been built to the order of Messrs. Furness, Withy & Co., Limited, West Hartlepool, for Messrs. Moore, Innes & Co., London. The vessel is built on the three-decked rule with one deck laid, having full poop, long bridge, and topgallant forecastle. The saloon and cabins for the captain and officers will be fitted up in the poop, the accommodation for engineers in iron house on the bridge deck, and the crew will be berthed in the forecastle as usual. She has double bottom on the cellular principle for water ballast throughout, and is also fitted with large after peak ballast tank. The vessel will carry about 5,000 tons deadweight on Lloyd's freeboard. She is fitted with direct steam windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft, five large steam winches, supplied with steam from an ample horizontal multitubular donkey boiler, with a general outfit fully up to date for a modern cargo steamer. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of about 1,100 I.H.P., steam being supplied by two large steel boilers, 15 ft. 3 in. by 10 ft. 3 in., the working pressure being 160 lbs. per square inch. The christening ceremony was gracefully performed by Miss Ropner, of Preston Hall, who gave the vessel the name of *London Bridge.*

Adriana.—On December 16th Sir Raylton Dixon & Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, the large steel screw cargo steamer *Adriana*, built to the order of the British Maritime Trust, Limited, of West Hartlepool. She is built to Lloyd's spar-deck rule, 100 A1 class, and has a deadweight carrying capacity of about 4,700 tons on a light draught of water. The upper decks are of steel and iron, and poop bridge and forecastle decks of pitch pine. The accommodation for officers, &c., will be handsomely fitted up in houses on bridge deck, and the crew will be located in the forecastle. Triple expansion engines will be fitted by Messrs. T. Richardson & Sons, Limited, Hartlepool, having cylinders 23 in., 36 in., 59 in. by 42 in. stroke, supplied with steam by two large boilers working at 180 lbs. pressure.

Huddersfield.—On December 16th Messrs. S. P. Austin & Son, Limited, launched from their shipbuilding and repairing premises, at the Wear Dockyard, Sunderland, the steel screw steamer *Huddersfield*, which has been built to the order of Messrs. John Ruthen & Co., of Cardiff, for the general trades, and to carry a large deadweight cargo on an exceptionally light draught of water. The vessel is built of steel, of the single-deck type, to class 100A1 under special survey in Lloyd's register, with dimensions as follow:—Length, between perpendiculars, 289 ft.; breadth, extreme, 45 ft.; depth, moulded, 21 ft. 2 in. She has poop, bridge, and forecastle, and the accommodation for the captain and officers will be provided in a large iron house on the bridge. Large water ballast capacity is provided for in the cellular bottom. The powerful steam winches have been supplied by Messrs. Roger & Co., direct steam windlass by Emerson & Walker, steam-steering gear (fitted in engine-room) by Donkin & Co., multitubular donkey boiler by Cochran & Co. The machinery will be supplied by Messrs George Clark, Limited, of Southwick Engine Works, Sunderland, of the triple-compound type, with large boiler power. The construction of the vessel has been carried out under the superintendence of Captain Harney, of Blyth, on behalf of the owners. The launch was successfully carried out in the presence of a number of friends of the builders and owners, and the vessel was named by Miss Ruthen, sister of the managing owner.

Schwarzenfels. — On December 16th Messrs. Wigham-Richardson & Co., Limited, launched from their Neptune Shipyard, Newcastle-on-Tyne, a steel screw steamer which they are building to the order of the Deutsche Dampfschiff fahrts Gesellschaft "Hansa," of Bremen. The steamer is 370 ft. long by 46 ft. beam by 30 ft. deep, and she is to be fitted with quadruple-expansion engines on the Yarrow, Schlick & Tweedy system, working at 210 lbs. pressure, which, together with the boilers, are being constructed by Messrs. Wigham-Richardson & Co., Limited. As the vessel left the ways she was named the *Schwarzenfels*, the christening ceremony being smartly performed by Master T. W. Bridge.

Shirley.—On December 18th Messrs. William Gray & Co., Limited, launched a large steel screw steamer for Messrs. Houlder, Middleton & Co., London. She will take the highest class in Lloyd's, and is of the following dimensions, viz.:—Length, over all, 341 ft.; breadth, 47 ft.; depth, 27 ft. 4 in.; with long bridge, poop, and topgallant forecastle. The saloon, staterooms, captain's and officers' rooms, &c., will be fitted up in the poop, the engineers' accommodation in houses on the bridge-deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and aft peak ballast tank, six steam winches, steam steering-gear amidships, hand screw gear aft, patent direct steam windlass, two patent donkey boilers, shifting boards throughout, stockless anchors, telescopic masts, with fore and aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer, Triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. William Gray & Co., Limited, having cylinders 25 in., 40 in., and 65 in. diameter, with a piston stroke of 42 in., and large steel boilers for a working pressure of 160 lbs. per square inch. The ship is being completed under the superintendence of Captain Satchell. The ceremony of naming the steamer *Shirley* was gracefully performed by Miss Mabel Rawlings, of Hartlepool.

Norfolk.—On December 18th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a handsome steel screw steamer built to the order of Messrs. Birt, Potter & Hughes, Limited, of London, for their well-known line of Australian steamers. The length of the vessel is 420 ft. between perpendiculars; breadth, 54 ft.; and depth, moulded, 32 ft. Classed 100 A1 Lloyd's special survey, three-deck grade, with shelter deck, also Board of Trade certificate for passengers. The sailors and firemen are berthed under the shelter deck aft. Accommodation for captain, officers, engineers, and a few passengers is made on the top of the shelter deck in large deck-houses. The saloon is tastefully fitted up in polished oak and replete with every comfort. The vessel is constructed on the deep-frame principle, thus dispensing with hold beams, and has cellular double bottom for water ballast all fore and aft, and both peaks fitted as tanks. The shelter, upper and main decks are of steel; her deadweight carrying capacity is about 9,000 tons. The deck machinery consists of ten large steam winches by Mr. R. Welford, of Pallion, direct steam windlass by Messrs. Emerson, Walker & Thompson Brothers, Limited; and Messrs. Donkin & Co.'s steam-steering gear, which is placed in the engine room and worked from the flying bridge, together with all the usual appliances for handling cargo and working the ship with the greatest possible despatch. The vessel is lighted by electricity by Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne. The main engines are upon the tri-compound principle, by Messrs. The North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, having cylinders, 30 in., 48 in., and 78 in., by 54 in. stroke, steam being supplied by three large steel boilers working at a pressure of 160 lbs. per square inch, with Howden's forced draught, also one large auxiliary donkey boiler. The vessel is being insulated throughout for the carriage of frozen meat, and the refrigerating machinery is being supplied by Messrs. J. & E. Hall, of Dartford. During construction the steamer and her machinery have been inspected, on behalf of the owners, by their superintendent, Mr. Morrison Upon leaving the ways the vessel was gracefully named *Norfolk* by Miss K. J. Adam, of Newcastle-on-Tyne, after which she was towed into the South Dock for the purpose of masting, &c.

Winkfield.—On December 19th there was launched from the works of Messrs. Short Brothers a large and handsomely modelled steel screw steamer built for the Australian trade, to the order of the Seafield Steam Shipping Co., Limited, of London, of which Messrs. Lawther, Latta & Co. are the managers. This vessel, which is constructed of steel, has been built under special survey to the highest class, in Lloyd's register, and is of the following dimensions: Length, 382 ft.; breadth, 48 ft.: and depth moulded, 30 ft.; having a large deadweight and measurement capacity of 10,000 tons. The erections consist of continuous shade deck from stem to stern, with large and commodious deckhouses on top of shade deck amidships for the accommodation of captain, officers and engineers, with large and handsomely fitted saloon, the panelling being in polished hardwood tastefully arranged. On the flying bridge deck a large and commodious teak wheel and chart house is fitted; the steam steering-gear is placed in the engine-room with controlling rods to the wheelhouse and flying bridge. The crew are berthed under the fore end of shade deck with separate berths for petty officers, &c. The double bottom is constructed on the cellular system, subdivided into trimming tanks, the peaks being also fitted for water-ballast. The holds are four in number for rapid loading and discharging, for which nine powerful steam winches have been fitted, steam for the same being supplied by a large multitubular donkey boiler placed in the boiler room. In addition the vessel is fitted out with all the newest appliances for despatch and economical handling of cargoes. A complete installation of electric light is also fitted. On leaving the ways the vessel was named *Winkfield*, the ceremony being performed by Mrs. R A. Lawther, of London. The vessel is to be fitted with triple-expansion engines by Messrs. George Clark, Limited, of Sunderland, having cylinders 26 in., 43 in., and 71 in. diameter with a stroke of 51 in. and having two large steel boilers of 180 lbs. working pressure fitted with Howden's system of forced draught.

LAUNCHES.—Scotch.

Jurupary.—On November 29th Messrs. Murdoch & Murray launched at Port-Glasgow a steel screw steamer named *Jurupary*, being another of the fleet which this firm are building for passenger and cargo service in South American waters. This vessel was towed to Glasgow to be engined by Messrs. Lees, Anderson & Co.

Engineer.—On November 30th the Grangemouth Dockyard Co. launched from their yard at Grangemouth a handsomely modelled steel screw steamer, which has been built to the order of Messrs. Tatham, Bromage & Co., of London. The dimensions of the vessel are 198 ft. between perpendiculars by 30 ft. by 15 ft. 4 in. moulded, and she has been built specially with a view to the carriage of heavy weights. The engines are fitted in the after part of the vessel, the entire length to the collision bulkhead being one clear hold, free from pillars and such obstructions, and the main hatch 48 ft. long, so as to admit long pieces of machinery, boilers, or other goods. Steel derricks and unusually powerful steam winches are provided for the purpose of handling weights up to 15 tons. Comfortable accommodation is provided in the bridge before machinery space for captain, a few staterooms, and saloon. A cellular double bottom for water ballast is fitted the whole length of the hold, and the net tonnage of the vessel has been reduced to the lowest possible point. As she left the ways the vessel was gracefully named *Engineer* by Miss Edith Millar, daughter of Mr. Millar, of the Dockyard Co. Triple-expansion engines of large power, with large boiler working at 170 lbs. pressure, will be fitted, and the vessel equipped with all the latest appliances, including steam windlass, steam-steering gear, steam warping capstan, and special hold ventilation.

Citrine.—On November 30th Messrs. A. Rodger & Co. launched at Port-Glasgow a steel screw steamer of 1,750 tons gross register, to carry 2,750 tons deadweight, for Mr. William Robertson, Glasgow. The dimensions are: Length, 260 ft.; breadth, 37 ft.; depth, 19 ft. 5 in. Miss Jean Kay Rodger performed the ceremony of naming the steamer *Citrine*. Messrs. Muir & Houston, Glasgow, will supply the machinery.

Horatia.—On December 3rd there was launched from the Inverkeithing yard of Messrs. Menzies & Co, Limited, Leith and Inverkeithing, the first of two steam welled fishing vessels for the Rushworth Steam Fishing Co., Limited, Grimsby, of the following dimensions:—120 ft. by 21 ft. 6 in. by 12 ft., and fitted with triple-expansion engines, having cylinders 12 in., 20 in., and 34 in. in diameter, by 24 in. stroke, with a large boiler working at a pressure of 200 lbs. This vessel has been built for the Iceland trawling and line fishing industry, and has been designed with a large subdivided well amidships, in which the fish are kept alive after being caught till landed in the British markets. The well is in direct communication with the sea, and a constant circulation of sea water is provided for. The bunkers are of large dimensions, carrying over 100 tons of coal, so as to enable the vessel to steam to Iceland and back without coaling. Independent of the well for keeping the fish alive, the vessel is fitted with fish holds in which a portion of the catch of fish is kept in ice, and a large insulated ice hold is fitted, with easy access to fish hold. This is the first welled vessel which has been built on the River Forth, and when completed will be one of the largest and most powerful vessels fishing out of an English port. The whole of the material used in the construction of the vessel is 20 per cent. above Lloyd's requirements, and all fittings, such as winch, &c., are of the strongest and most modern design. The vessel on leaving the ways was named *Horatia* by Miss Menzies, Elstree, Edinburgh, and after the launch was towed to Leith to ship her machinery.

Lucy.—On December 6th Messrs. Fleming & Ferguson, Limited, launched at Paisley the *Lucy*, a steel hopper dredger, built for the Llanelly Harbour and Bury Navigation Commission. The dredger is to be capable of raising 450 tons of material per hour from a depth of 30 ft, and is designed to enable her to cut in front and make her own flotation. She is fitted with all the latest improvements for vessels of this type.

Setter.—On December 6th there was launched by Messrs. Hall, Russell & Co., Limited, at Aberdeen, a steam trawler, built to the order of Captain Burn, St. Andrews. It is about 175 tons gross, has been constructed to class 100 A1 at Lloyd's, and will be fitted with a steel boiler and triple-expansion engines of 320 I.H.P. The vessel was named the *Setter*.

Bellona.—On December 7th Messrs Russell & Co. launched from their Greenock yard a steel screw steamer named *Bellona*, of 1,625 tons gross, for German owners. This is one of the vessels laid down by Messrs Carmichael, M'Lean & Co., and which Messrs. Russell & Co. undertook to complete when they took over the yard.

Rourik.—On December 7th, Messrs. Archibald McMillan & Son, Limited, Dumbarton, launched the steel screw steamer *Rourik*, which they have built to the order of the Volga Steam Shipping Co., of St. Petersburg. The dimensions of the *Rourik* are 178 ft. by 26 ft. by 14 ft., and she is built to Lloyd's 100 A.1 class.

Pena Sagra.—On December 7th Messrs. Robert Duncan & Co., Limited, launched at Port-Glasgow a steel screw-steamer of 1,600 tons gross to carry 2,700 tons deadweight for the Campania Santanderina de Navegacion, of Santander. The dimensions are:—Length 260 ft.; breadth, 37 ft.; depth, 20 ft. 6 in. The vessel, which is of the single-deck type, was named *Pena Sagra* by Miss Denny, Dumbarton, daughter of Mr. Archibald Denny, shipbuilder. Triple-expansion engines will be supplied by Messrs. Hall-Brown, Buttery & Co., Glasgow, the cylinders being 19 in., 30½ in., and 50 in. by 36 in. stroke.

Alcinous.—On December 7th, Messrs. Scott & Co. launched at Greenock a steel screw steamer named *Alcinous*, for the Ocean Steamship Co., Liverpool, the fourth of an order for eight steamers. Dimensions:—Length, 440 ft.; breadth 52 ft.; depth 33½ ft.; of 6,700 tons gross and 8,200 tons carrying capacity. The builders will supply engines of 4,500 I.H.P.

Cracker.—On December 7th, the London and Glasgow Engineering and Shipbuilding Co., Limited, launched from their shipyard, Govan, the second of the two powerful paddle steamers ordered from them by the British Admiralty. Her principal dimensions are:—Length 144 ft.; breadth 27 ft. 3 in., of 700 tons displacement. The engines are of the twin-paddle type, with diagonal oscillating cylinders, and boilers of the multitubular type, they being also supplied by the builders. As the vessel left the ways she was named *Cracker*, by Miss Jago, Carrickarden, Bearsden.

Teresa.—On December 8th Messrs. Russell & Co. launched from their Kingston Yard, Port-Glasgow, a steel screw steamer of 6,400 tons deadweight carrying capacity. The dimensions are: Length, 345 ft.; breadth, 49 ft. 9 in.; depth, 28 ft. 5 in. The steamer is named *Teresa*, and is built to the order of Messrs. Fratelli Cosulich, of Trieste, making the second steamer built by Messrs. Russell & Co. for this firm. Triple-expansion engines will be supplied by Messrs. Blackwood & Gordon, Port-Glasgow, the cylinders being 25 in., 41 in., and 67 in., by 45 in. stroke.

Titania.—On December 14th Messrs. A. Hall & Co. launched at Aberdeen a steam trawler, built to the order of the Hellyer Steam Fishing Co., Hull. She has a gross tonnage of about 200, and will be fitted with triple-expansion engines. She was named the *Titania*.

Goldseeker.—On December 14th Messrs. John Duthie, Sons & Co launched at Aberdeen, a finely modelled steel trawler, built to the order of Messrs. North, Ellis & Co., Grimsby. The vessel, which was named the *Goldseeker*, has a gross tonnage of 190, and will be fitted with triple-expansion engines.

Dunlossit and **Helen.**—On December 14th there was launched from the shipbuilding yard of Messrs. John Shearer & Son, at Kelvinhaugh, two steel screw steamers, viz., *Dunlossit*, for Messrs. Paton & Hendry, and *Helen*, for Mr. J. Cameron, Glasgow. Dimensions are: 124 ft. by 22 ft. by 10 ft. 3 in. moulded, with raised quarterdeck, short bridge, and topgallant-forecastle. They have been built to Lloyd's highest class, with extra scantlings to enable them to be loaded on the ground. Deadweight carrying capacity with Lloyd's freeboard about 280 tons. Fore and aft peaks are trimming tanks. Compound surface-condensing engines, 14 in. and 29 in. by 21 in. are being fitted on board by Messrs. Muir & Houston, Limited, Kinning Park.

Canganian.—On December 14th Messrs. Mackie & Thomson launched at Govan a steamer 225 ft. by 34 ft. by 16 ft. 6 in. depth, moulded, with fullpoop, raised quarter-deck, bridge, and topgallant forecastle. The vessel is fitted out with all the latest improvements for the rapid handling of coal and other cargoes. Triple-expansion engines will be fitted by Messrs. Ross & Duncan, having cylinders 17 in., 28 in., and 45 in., by 33 in. stroke, working at 180 lbs. pressure. The vessel has been built for Messrs. Owen & Watkin Williams & Co.. of Cardiff, and has been superintended during construction by Captain Watkin Williams. The vessel was christened *Canganian* by Mrs. Griffith, wife of the commodore engineer to the owners.

Vladimir.—On December 15th Messrs. Archd. M'Millan & Son, Limited, launched at Dumbarton, the steamer *Vladimir*, which they have built to the order of the Volga Steamship Co., of St. Petersburg. Her dimensions are 178 ft. by 26 ft. by 14 ft. and she is built to Lloyd's 100 A1 class. The machinery is being supplied by Messrs. M'Kie & Baxter, Glasgow.

Tupa.—On December 15th Messrs. Murdoch & Murray, Port-Glasgow, launched another of the fleet of steamers they have on order for cargo and passenger service on the River Amazon. The steamer is named *Tupa*, and will be engined by Messrs. Kincaid & Co., Greenock.

Fleswick.—On December 16th the Ailsa Shipbuilding Co., Troon, launched from their yard a steel screw steamer for Mr. Robert Simpson, of Whitehaven. The dimensions are:—Length, 178 ft. 6 in.; breadth, 27 ft. 6 in.; depth, moulded, 13 ft. 9 in. The machinery is being supplied by Messrs. M'Kie & Baxter, Govan. The steamer was named *Fleswick* by Miss Crockett, Logan Bank, Troon.

Marwarri.—On December 16th there was launched by Gourlay Brothers & Co. at Dundee the large vessel *Marwarri*, for T. & J. Brocklebank, Limited, Liverpool. She has a gross tonnage of 5,820, and her other principal dimensions are:—Length, 445 ft.; beam, 50 ft.; depth, 33 ft. The *Marwarri* will sail chiefly between Dundee and Calcutta, having been specially designed for the jute trade.

Val de Travers.—On December 16th there was launched from the shipyard of Messrs. S. McKnight & Co., Limited, Ayr, a handsomely modelled screw steamer of about 1,000 tons. The vessel has been constructed of steel to the highest class of Lloyd's registry for general trade, and to the order of a well-known London shipowner. The vessel on leaving the ways was gracefully christened *Val de Travers* by Mrs. John S. Watson, Woodcroft, Ayr. The vessel proceeded to Glasgow in order to receive her machinery, which is being supplied by Messrs. Ross & Duncan, Govan.

Saxonia.—On December 16th Messrs. John Brown & Co., Limited, launched at Clydebank the *Saxonia*, a twin-screw steamer of about 14,000 tons gross, and of the following dimensions:—Length, between perpendiculars, 580 ft.; length, over all, 600 ft.; breadth, extreme, 64 ft. 3 in.; moulded depth from upper deck, 41 ft. 6 in., which they have built for the intermediate Atlantic service of the Cunard Line. More than ordinary interest centred in the floating of the vessel, for she is not only the biggest ever built on the Clyde, but is also one of the ten largest in the world. The Fairfield greyhounds, *Campania* and *Lucania*, are, it is true, both longer than the new boat, but in point of tonnage the *Saxonia* is easily greater. The vessel is of the complete shelter-deck type, with lofty erections amidships intended for the accommodation of passengers. The numbers provided for are:—First-class, 164, and third-class about 500. There is also provision for a very large number of steerage passengers. The first-class passengers are berthed in handsome and commodious rooms on the bridge deck. The dining saloon, in which 150 passengers may be seated, is on the shelter deck, and is lighted and ventilated by a large and handsomely decorated skylight overhead, and by ventilating lights at the sides. The whole of the third-class accommodation is fitted so as to be readily removed in case the space is required for cargo. Considerable space has been reserved in the ship in a position which is eminently suited for second-class accommodation, if the owners should deem it expedient to make provision for carrying this class of travellers. The whole of the upper deck at the after end will be fitted for the safe carriage of horses and cattle. The hull is generally of mild steel, and the scantlings are somewhat in excess of the requirements for Lloyd's highest classification. The subdivision is such that the vessel would be unsinkable by any damage not of an extraordinary kind. The arrangements for the carriage and working of cargo are of a very complete description. The four masts with a large number of derricks and cargo spans, are fitted so that the work of discharging will be carried out with the greatest expedition. A considerable volume of 'tween-deck space is insulated and fitted up for the safe carriage of perishable cargoes. A very large fresh-water capacity has been provided, so that there may be no lack of this necessary, both in respect of passengers, crew, and cattle. To meet the necessary conditions of seaworthiness when going westward only partially laden, deep water ballast holds have been provided, in addition to the usual water-ballast tanks within the limits of the double-bottom compartments. The ship is lighted throughout by electricity, and the latest pattern appliances in the way of capstans, warping and cargo winches, steering-gear, &c., are included in her equipment. Twin screws have been provided, each actuated by quadruple-expansion engines, and the steam is supplied from nine single-ended boilers working under forced draught. The Hon. Mrs. G. A. Burns performed the christening ceremony.

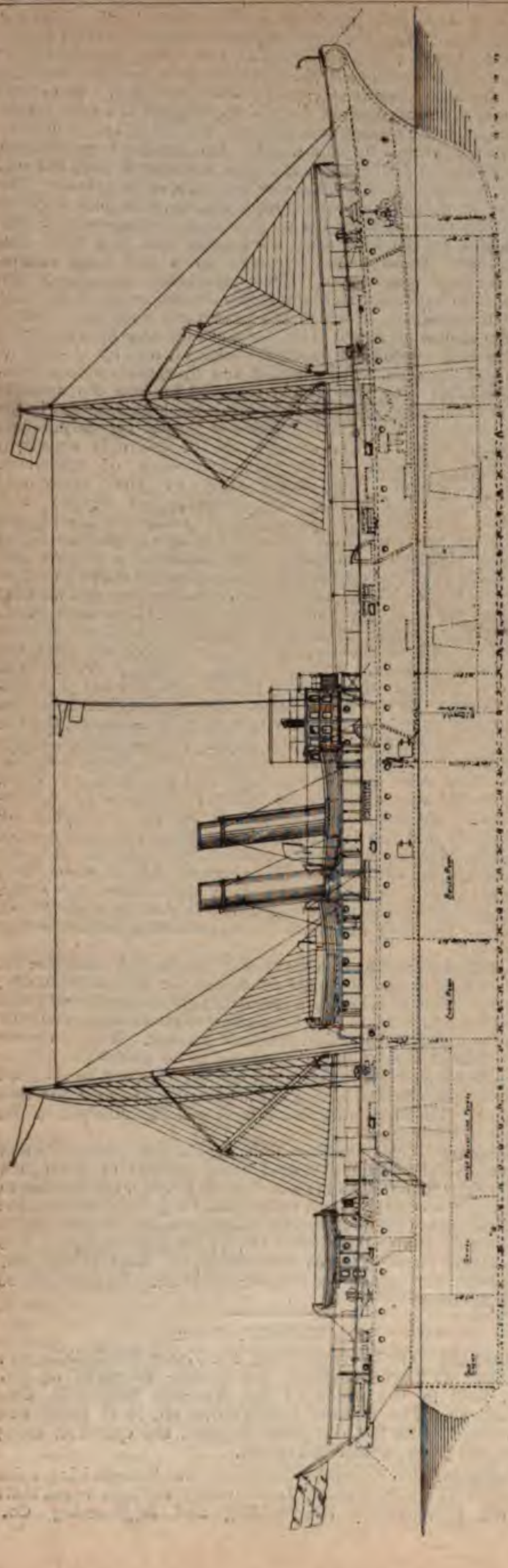
H.M.S. Assurance.—On December 18th H.M.S. *Assurance* was launched from the shipyard of Messrs. J. M'Arthur & Co., Paisley. The *Assurance* is a powerful light-draught steel twin-screw tug, and is fitted with twin-screw triple-expansion engines by Messrs. Bow, M'Lachlan & Co., of Paisley. The *Assurance* is the first of three similar steamers to be completed by the above firms, and these tugs, when handed over, will be attached to the torpedo flotilla, having been specially designed for that purpose. The remaining two vessels will be launched in the course of a few weeks.

Mambare.—On December 18th the Campbeltown Shipping Co. successfully launched a steel screw steamer of 2,200 tons deadweight, built to the highest class at Lloyd's, for Australian owners. The vessel, which is designed for general trading, has accommodation for 40 first-class passengers, and is the second supplied by the Campbeltown Co. to the Sydney firm. The christening ceremony was performed by Miss Macfadyen, Beachhill, who named the steamer *Mambare*. Engines will be fitted at Glasgow.

LAUNCHES.—Irish.

Riverside.—On November 22nd the Larne Shipbuilding Co. launched at Larne Harbour the steamer *Riverside*, of 165 tons, built to the order of the Riverside Steamship Co., Portadown. The steamer is 95 ft. over all, 19 ft. broad, and 9 ft. deep. She has compound engines, the cylinders being 12 in. and 24 in., with 18 in. stroke.

Parkside.—On December 16th there was launched from the Foyle Shipbuilding Yard at Londonderry the first vessel built by the Londonderry Shipbuilding and Engineering Co.



TWIN-SCREW CABLE STEAMER VON PODBIELSKI, BUILT AND ENGINED BY MESSRS. DAVID J. DUNLOP & CO., INCH WORKS, PORT-GLASGOW.

(See December issue page 419.)

Limited. She has been constructed to the order of Mr. Marshall, of Liverpool. Her principal dimensions are:—Length over all, 372 ft.; breadth, 46 ft. 3 in.; depth, 28 ft. 6 in.; to upper deck beams. The vessel has been designed to carry a deadweight of 6,200 tons, and has a gross register tonnage of about 3,680 tons, and has been constructed of steel throughout to Lloyd's highest class 100 A1, with poop, long bridge, and forecastle, and with large capacity for water-ballast in double bottom, which extends the full length of the ship. The peaks, or forward and after ends, are also arranged for water-ballast. There are two complete steel docks running the whole length of the ship, and five extra large hatchways, worked by 10 derricks, four of which are stepped on each mast, and two on crane posts, which have been introduced on the bridge deck. The engines, which are of the usual triple-expansion type, together with boilers, &c., are being supplied by a firm of engineers on the Clyde. Her Grace the Duchess of Abercorn performed the christening ceremony, the vessel receiving the name of *Parkside*.

TRIAL TRIPS.

Don Hugo.—On November 21st and 22nd the steamer *Don Hugo*, built by David J. Dunlop & Co. (of which we gave full particulars in our Launch columns, October issue, page 330), ran her speed trials on the Clyde. The trials were made at the Skelmorlie measured mile, when the builders' progressive runs were satisfactorily completed. The results proved the steamer's capability of easily attaining, when loaded with a deadweight of 2,500 tons, her guaranteed speed of 12½ knots.

Hannover.—On November 25th the steamer *Hannover*, built by Messrs. Wigham-Richardson & Co., of Newcastle-on-Tyne, for the North German Lloyd Company, of Bremen (of which we gave particulars in our Launch columns, September issue, page 283), was taken on her official trial trip, when she behaved in a manner quite satisfactory to her builders and to the representatives of those to whose order she has been constructed. The speed attained exceeded that guaranteed.

Gadsby.—On November 29th the new steamer *Gadsby*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. R. Ropner & Co., of West Hartlepool (of which we gave particulars in our November issue, page 369), made her official trial trip in the Tees Bay, after loading a full cargo in the Tees. After the adjustment of compasses, the vessel proceeded on her way to Beira, Africa. The vessel has been built under the inspection of Mr. Nicholson, the owners' superintendent surveyor, and he was present at the trial trip, which passed off very satisfactorily in all respects.

Hyson.—On November 29th the large new steamer *Hyson*, built by Messrs. David & W. Henderson & Co., to the order of Messrs. the China Mutual S.N. Co., Limited, London (of which we gave particulars in our November issue, page 371), proceeded down the river, and in the course of the day ran trials on the firth. During the day the machinery worked without a hitch, and gave every satisfaction to the owners, who were represented by W. A. Gulland, Esq., managing director, Captain J. S. Hogg and Mr. H. G. Seal. A speed of 13½ knots was easily obtained, which was considered most satisfactory. Immediately after the trials the vessel left for Liverpool, where she will complete loading for the East.

Sandsend.—On November 29th the large steel screw steamer *Sandsend*, built by Messrs. W. Gray & Co., Limited, to the order of Messrs. the Pyman Steamship Co., Limited, West Hartlepool (of which we gave particulars in our November issue, page 369), was taken to sea for her trial trip, when a very successful trial was made, everything in the engine-room working with the utmost smoothness and precision, and the ship averaging a speed of 11¾ knots against the tide. On the conclusion of the trial the vessel proceeded to the Tyne, where she loads for a Mediterranean port.

Mora.—On November 29th the screw steamer *Mora*, built by Messrs. J. Readhead & Sons, West Docks, South Shields, went on her official trip from the Tyne, which proved eminently satisfactory, 11½ knots being registered. The steamer has been built to the order of the English and American Shipping Co., Limited, of which the managers are Messrs. C. T. Bowring & Co., of London, and is of the following dimensions:—Length, 335 ft. over all; breadth, 47 ft.; and depth, moulded, 25 ft. She is of the improved single-deck type, with full poop, long bridge amidships, cabin houses on deck for captain, officers, and engineers, and topgallant forecastle for crew, iron shifting boards, &c., and has a large deadweight capacity on a light draught. She has been built under special survey, is classed 100 A1 at Lloyd's, and fitted with all the latest improvements and appliances for the working of the steamer, and for the rapid loading and discharging of cargo. Her engines, also built by Messrs. John Readhead & Sons, are of the triple-expansion type, having cylinders 24 in., 40 in., and 64 in., by 45 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch. The steamer has been specially fitted for the grain trade, and it may be also mentioned that she is the seventh vessel built by Messrs. J. Readhead & Sons for the same owners. The *Mora* proceeded to Tyne Dock later in the day to take in cargo for Genoa, Captain J. Nicholson being in command.

Sebriana.—On November 30th the screw steamer *Sebriana*, built by Messrs. Short Brothers to the order of the British Maritime Trust, Limited, of London (of which we gave particulars in our November issue, page 370), went out on trial with very satisfactory results. After adjusting compasses the vessel was taken a series of runs over the measured mile, when a mean speed of 13 knots was attained.

Korea.—On November 30th the s.s. *Korea*, which has been built by the Flensburg Shipbuilding Co., Flensburg (of which we gave particulars in our November issue, page 373) put out to sea for her official trial trip. Before this the vessel was transferred to the Russian flag, on which occasion the unique ceremony of blessing the vessel and crew in accordance with the Russian custom was witnessed. The Russian priest, in blessing the ship, sprinkled consecrated water in all parts, after which the same ceremony was gone through in the case of each of the crew, the whole being a most impressive scene. Both the Russian and Danish companies' representatives expressed themselves as highly satisfied with both the ship and machinery, which ran at a speed of 13¾ knots during the trial.

Kilnsea.—On November 30th the large steel screw steamer *Kilnsea* had her official trial. She has been built by Messrs. W. Gray & Co., Limited, to the order of Messrs. W. Brown, Atkinson & Co., Limited, for the Sea Steamship Co., Limited, Hull, (of which we gave particulars in our December issue, page 415). An average speed of 11 knots was recorded with the log overboard. The vessel proceeded to the Tyne to load for Genoa.

Humber.—On December 2nd the s.s. *Humber*, built by the Ardrossan Dry Dock and Shipbuilding Co., Limited, to the order of the Grangemouth Dockyard Co., Grangemouth, on behalf of Mr. E. P. Hutchinson, of Hull, proceeded to sea on her trial trip. After a run of about two hours, in which the vessel attained a speed of nine knots, loaded, and satisfactorily acquitted herself in every respect, she returned to Ardrossan preparatory to making her maiden voyage. Messrs. Walker, Henderson & Co., Glasgow, supplied and fitted the engines.

Everingham.—On December 6th the steamer *Everingham*, built to the order of Messrs. Alexander Meek & Sons, of Goole and Hull, for the East Yorkshire Steamship Co., by the Blyth Shipbuilding Co., Limited, of Blyth, was taken to sea for her official trial trip. The vessel measures 337 ft. in length; 47 ft. beam; and 24 ft. 10 in. depth, and has been constructed on the three-deck principle with single deck laid. She has an open poop, long bridge with accommodation on top of same in iron houses for captain, officers, and engineers, topgallant forecastle, iron shifting boards, and complete outfit for the quick working of the vessel and her cargo. The machinery has been supplied and fitted by Messrs. Blair & Co., Limited, of Stockton-on-Tees. The triple cylinders are 24 in., 40 in., and 65 in., with a stroke of 42 in., steam being supplied from two large boilers. The trial was in every way successful to all interested. Both the hull and machinery have been constructed under the superintendence of Mr. T. H. Jenkins, of Messrs, J. Jamieson & Co., of Hull. The *Everingham*, after adjusting compasses, sailed for Odessa under the command of Captain Newlove.

Heemskerk.—On December 7th this vessel was taken to sea for trial, from the yard of Messrs. Cochrane & Cooper, Limited, where she has been built by them to the order of Messrs. Van Vliet & Co., of Ymuiden, Holland. The vessel (of which we gave particulars in our November issue, page 370) is the sister ship to the s.s. *Barendez*, built and tried by the same firm, and has been designed and constructed under the supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. An exhaustive trial of the machinery was made, everything proved satisfactory and the vessel sailed on her maiden voyage.

Stanleyville.—On December 7th the fine twin-screw mail and passenger steamer *Stanleyville*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, to the order of Messrs. Elder Dempster & Co., of Liverpool, for the Compagnie Belge Industrielle du Congo, of Antwerp, proceeded to sea under the command of Captain G. B. Sparrow. This vessel is intended to run in the Belgian Mail Line between Antwerp and the Congo, and is the seventh vessel built by Sir Raylton Dixon & Co., Limited, for the same trade. Her dimensions are:—382 ft. by 46 ft. by 25 ft. moulded. Accommodation is provided in most spacious and handsomely fitted cabins for 108 first-class and 80 second-class passengers, with large dining-room in house on deck panelled in marble and inlaid wood. The smoking rooms and cabin entrances are elaborately fitted and decorated, and the vessel is lighted throughout with electric light. A powerful refrigerating machine with large cooling chambers is also provided for the conveyance of fresh meat, provisions, etc. Twin-screw triple-expansion engines have been fitted by Messrs. the Wallsend Slipway and Engineering Co. Limited, Newcastle on-Tyne, having cylinders 21½ in., 34 in., 59 in. by 42 in. stroke, supplied with steam by four single-ended boilers, working at 180 lbs. pressure, and fitted with Howden's system of forced draught. The hull and engines have been built under the personal supervision of Mr. Butterworth. A number of friends were on board during the trial trip, which passed off most successfully, the vessel afterwards proceeding to Antwerp.

Glencoe.—On December 9th the s.s. *Glencoe*, the first of a fleet of seven built by A. & J. Inglis, Glasgow, for Mr. R. G. Reid, of Newfoundland, was tried on the Firth of Clyde with satisfactory results. The *Glencoe*, though of moderate size, has been fitted up in the most comfortable manner for passengers, the first-class being amidships, the sleeping cabins on lower deck, and the saloon above main deck in a steel deck house lighted by large square ports. She is electrically lighted throughout, and a powerful searchlight is placed on the upper bridge to facilitate entering harbour in the night time. The speed on trial was 12·8 knots, which was maintained with ease.

Eduard Bary.—On December 12th the new steamer *Eduard Bary*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. Furness Withy & Co., Limited, of West Hartlepool, for account of Mr. Paul Morch, of St. Petersburg (of which we gave particulars in our December issue, page 417), made her official trial trip in the Tees Bay. After the adjustment of compasses, she proceeded on her run to the Tyne to load for the Mediterranean. The vessel has been built under the inspection of Captain Ingersley, the owner's superintendent surveyor, who was present at the trial trip, and who expressed entire satisfaction with the vessel in all respects.

Hesperides.—On December 13th the steamship *Hesperides*, which has been built by Messrs. Bartram & Sons, Sunderland, for Messrs. R. P. Houston & Co., Liverpool (of which we gave particulars in our Launch columns, December issue, page 415), was taken for a trial trip. The weather was very stormy, but the vessel showed first-rate seagoing qualities, and attained a speed of 14 knots, everything working smoothly and satisfactorily. At the completion of the trial trip the *Hesperides* proceeded to Glasgow, under the command of Captain Marsh.

British Prince.—On December 14th the finely modelled steel twin-screw steamer *British Prince*, built by the Palmer's Shipbuilding and Iron Co., Limited, Jarrow-on-Tyne (of which we gave particulars in our Launch columns December issue, page 415) was taken out to sea for her official steam trials. The engines, which have also been constructed by the Palmer's Co., are of the triple-expansion twin screw type, with cylinders 26 in., 43 in., and 71 in. diameter, by 48 in. stroke, steam being supplied by two double-ended boilers, 15 ft. 3 in. diameter by 17 ft. 6 in. long, and two single-ended boilers 15 ft. 3 in. diameter by 11 ft. long, with a working pressure of 190 lbs. During the trial the engines worked in a highly satisfactory manner.

Hope.—On December 14th the trial trip of the steam trawler *Hope* took place and proved highly satisfactory, a speed of 10¼ knots being obtained on the measured mile. The vessel (of which we gave particulars in our December issue, page 421) was built by the Irvine Shipbuilding and Engineering Co., Limited, for the Peterhead Trawling Co., Limited.

Manchester Commerce.—Lately the trial trip of the *Manchester Commerce* took place in Hartlepool Bay, the results being most satisfactory. The vessel (of which we gave particulars in our Launch columns, September issue, page 283) has been built for the regular Canadian service of the Manchester Liners, Limited, by Messrs. Furness, Withy & Co., Limited.

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 8th to December 6th, 1899.

22042 J. Brown & Co., Limited, and W. C. Wallace. Flues.
22057 G. Duncan. Steam valves.
22063 H. Shand. Screw propeller.
22102 J. Y. Buchanan. Cables.
22127 J. Patterson. Controlling engine telegraphs.
22137 H. Thormeyer. Rotary steam engines.
22142 C. A. Allison. (The Eureka Iron Co., United States.) Steam traps.
22173 C. B. Peake. Manhole boiler.
22174 R. Scott. Water-tube steam generators.
22175 R. Scott. Furnaces for generating steam.
22176 F. C. Blake. Heat-radiating apparatus.
22206 A. Purvis and W. Harbinger. Plugs for boats.
22213 T. Christie. Beds for use on board ship.
22239 J. Shepherd and F. Glover. Steam boilers.
22247 E. J. Preston. Ships' closets.
22248 R. T. Preston and G. C. Ralston. Ventilating ships.
22260 H. H. Lake. (J. B. Millet, United States.) Submarine telegraphy.
22266 A. W. France. Metallic packings for piston rods.
22281 H. H. Lake. (E. H. Gollings, United States.) Steam engines.
22300 S. Hunter and G. Milne. Lubricating shafts.
22304 P. Hassall. Tackle for discharging cargoes.
22313 R. Wilby. Governor for engines.
22334 G. M. Demoulin. Engines.
22369 E. Lisle and G. Prew. Oil engines.
22373 J. J. Guest. Pressure gauges, etc.
22398 C. D. Abel (Dampfkessel und Maschinenbau Actiengesellschaft, W. Fitzner and R. Gamper, Russia.) Corrugated tubes.
22413 A. O. Neville and J. Carpenter. Preventing downdraught in flues.
22416 J. E. Thornycroft. Water-tube boilers.
22435 W. Smith. Propellers for vessels.
22454 W. R. Renshaw. Packing rings.
22468 T. G. Challis and W. J. Hunter. Armour plates.
22474 R. Bensal. Regulating draught in furnaces.
22486 F. H. Heath. Anti-friction axle bearings.
22493 C. E Dawson. Clutches for operating propellers.
22507 R. Jackson and A. Firth. Starting engines.
22508 R. Jackson and A. Firth. Friction clutch.
22526 W. P. Thompson. (G. Reibaldi and C. Mazza, Italy.) Steam generators.
22538 W. Schmidt and H. Elsner. Boilers.
22568 W. Schmolka. Equilibrium slide valves.
22572 F. Schilling and J. Schurz. Expanding holes in tubes.
22577 A. E. Sayer. Friction clutches.
22590 J. Shaw and J. Grantham. Ship lights.
22601 J. C. Hoch, J. F. and H. Tietgen. Winches.
22603 G. D. Irwin. Trawl boards for fishing.
22604 K. F. Hoglund. Device for use of swimmers.
22607 F. M. Chappell. Feed water regulator.
22626 A. G. Evans. (J. W. W. Hopkins, Argentine Republic.) Breakwaters.
22634 C. H. Taylor. Engines.
22636 C. E. Dawson. Oil engines.
22683 P. M. Staunton. Ships' propellers.
22699 A. J. Boult. (R. W. Jamieson, United States.) Stearing gear.
22700 A. Craig. Oil feed for explosion engines.
22713 E. Seger. Friction couplings.
22729 J. B. Foxwell. Valves for pulsating steam pumps.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class; 2C Second Class.

November 25th, 1899.

Alder, John F. 1C London
Ambler, Thos... 1C Liverpool
Appleton, Albert 2C W.Hart'l
Arrol, Chas..... 2C Glasgow
Blair, John .... 2C Liverpool
Brown, Geo. F. 1C ,,
Buchan, Wm. F. 1C Glasgow
Campbell, Colin 2C S'h'pt'n
Clark, Alex..... 1C W.Hart'l
Corkhill, Jas. C. 1C Liverpool
Crocker, G. A. J. 1C Cardiff
Davies, Edwd. L 1C Liverpool
D owson, Wm.W 2C W.Hart'l
Death, Chas. .. 1C London
Dossett, Jas. H. 1C W.Hart'l
Dowson, Wm... 2C N.Shields
Duncan, Geo. N. 1C Glasgow
Emmerson, J... 1C N.Shields
FarquharsonJ.J. 1C Glasgow
Forrest, Allison 1C N.Shields
Gordon, David.. 1C Dundee
Govan, Andw J. 1C Liverpool
Hoole, John.... 1C N.Shields
Hurst, Chas. E. 1C Liverpool
James, Arthur J 1C W.Hart'l
Kingston, Robt. 1C ,,
Leach, Walter J. 2C Liverpool
Liddell, Percy.. 2C W.Hart'l
Lightley, Thos.H 2C N.Shields
Miller, John .. 2C Glasgow
Milne, John R. 2C Dundee
Nance, Jas.W... 1C W.Hart'l
Noble, Chas. .. 1C ,,
Painter, Edward 2C ,,
Pressley. FredW 1C Liverpool
Ritchie, Andrew 1C Glasgow
Robertson W. A. 2C ,,
Smith, Wm.K.H. 2C London
Stephenson, T. 2C Cardiff
Swansea, JohnH 2C N.Shields
Tucker, AlfredJ. 1C Cardiff
Tully, George.. 2C Liverpool
Walker, David 1C Glasgow
Williams, C. H. 1C Cardiff
Williams, W. J. 2C ,,

December 2nd.

Atkinson, Chas. 2C S'nd'land
Burnand, E. .. 2C Liverpool
Carter, W. G. .. 1C S'nd'land
Clark, FrancisR. 1C Hull
Connolly, W. D. 2C Liverpool
Crighton, A. .. 1C Aberdeen
Daly, John .... 1C ,,
Dunbar, Adam 2C ,,
Esson, James .. 1C ,,
Geddie, Wm. .. 1C ,,
Gibbs, Robt. J. 2C S'nd'land
Harris, John G. 1C Liverpool
Harvey, H. R... 1C London
Hayles, Wm. .. 1C Liverpool
Jamieson, W. R. 2C Aberdeen
Jones, Geo. A... 1C S'nd'land
Kemp, Duncan 2C Liverpool
Larken, John .. 2C ,,
Maver, James.. 2C Aberdeen
M'Queen, James 2C S'nd'land
Nelson, C. W... 2C ,,
Priestly, Percy 1C ,,
Richardson, T.T. 2C Hull
Richmond, F. J. 1C Liverpool
Scotland, Ernest 1C London
Sfaellos, A. G. 2C S'nd'land
Shillington, W. J 1C Liverpool
Taylor, A. G. .. 1C S'nd'land
Thompson, A.E. 2C ,,
Will, Alexander 1C Aberdeen
WilliamsonG.E. 1C Liverpool

December 9th.

Armour, R. P... 1C Glasgow
Bain, James .. 1C Liverpool
Bevan, Wm. T. 1C Cardiff
Billington, T. .. 1C Liverpool
Bramah, David 2C N.Shields
Bridges, G.E.D. 1C ,,
Burns, James.. 2C Glasgow
Burt, Wm. G... 2C ,,
Cockburn, H. .. 2C London
Cromar, C. A... 1C Glasgow
Davey, C. W. .. 1C London
Duckitt, Louis 2C N.Shields
Edwards, W. .. 2C Cardiff
Gidney, H. F... 1C N.Shields
Grant, T. L. .. 2C Cardiff
Harris, L. H. H. 1C London
Hindmarch, J. 2C N.Shields
Jackson, George 1C Liverpool
Johnston, Wm. 2C ,,
Kilpatrick, D... 1C London
Lavery, James 1C Glasgow
Legg, Robert .. 2C N.Shields
Leishman, A. .. 2C Glasgow
Lockhead, John 2C ,,
Macalpine, Geo. 1C London
MackintoshT.A. 2C Glasgow
M'Gill, Donald 2C ,,
Michael, E. R. 1C ,,
Midgley, W. E. 1C Falmouth
M'Tear, Jas. H. 1C Glasgow
Nicholson, Wm. 2C N.Shields
Rintoul, John.. 1C Glasgow
Ritchie, JohnW. 1C ,,
Saville, C. R. .. 1C London
Savinos, George 2C Glasgow
Service, R. S. .. 2C ,,
Smith, John C. 1C Cardiff
Smith, Robert.. 2C Glasgow
Stokoe, F. A. .. 1C N.Shields
Taylor, George 2C Liverpool
Thomas, J. H. 1C ,,
Thomas, W. J. 1C Cardiff
Tully, Edwin.. 1C N.Shields
Veale, Wm. J... 1C Falmouth
Walker, Jas. S. 2C Glasgow
Watson, Harry 2C Cardiff
Whitburn, H. J. 2C ,,
Woods, Thomas 1C London

December 16th.

Archibald, W. S. 2C Leith
Arter, Wm. L. 1C Liverpool
Bacalbassis, S... 1C London
Brown, John .. 2C N.Shields
Cairns, James.. 1C ,,
Cauley, Jas. T. 2C ,,
Cross, Geo. A... 2C Liverpool
Donaldson, Jas. 1C ,,
English, Jas. E. 2C ,,
Forster, Wm. .. 2C N.Shields
Frank, Albert E. 2C Hull
Gillespie, J. Y. 2C Leith
Greig, James .. 1C Liverpool
Hedley, John F. 2C N.Shields
Hewat, H. A. .. 2C Greenock
Hoar, Henry S. 2C Liverpool
Ireland, T. J. .. 1C Greenock
Jenkins, J. W. 2C Liverpool
Keenlyside, T. 2C N.Shields
Hinley, John .. 2C Greenock
Lawson, Robert 1C Leith
Lewis, Henry P. 2C Greenock
Loughlin, P. H. 1C Liverpool
MacLeod, A. .. 2C Greenock

The Marine Engineer.

LONDON, FEBRUARY 1, 1900.

ALTHOUGH seamen are excluded from the benefits of the Workmen's Compensation Act of 1897, other parts of the shipping industry constitute one of the largest employments to which this statute applies. The very high rates payable for insuring the liability of employers in this trade for compensation to their workmen who suffer accidental personal injuries in the ordinary course of their labour became a serious and vexatious grievance for several months after the Act came into force. It may, however, be now justly stated that there are but comparatively few complaints about the amount of premiums charged by the insurance companies for undertaking the liability referred to, on account of the increased keenness of competition for such risk. Indeed, so great is the scramble for this and other risks under the Workmen's Compensation Act that, it has been well said by a contemporary on this point, so strong are the efforts to secure this business that they are but little restrained by prudential considerations, and that the order of the day concerning employers' liability insurance appears to be, "Get business—profitably if you can—but in any case get business." As regards the rates payable for different classes of risks in the shipping trade, these vary greatly, and also often materially differ from similar risks in the same locality. The average rates for shipbuilders and ship repairers range from 10s. to 25s.; for marine engineers, from 7s. 6d. to 12s. 6d.; and for loaders and unloaders generally, from 25s. to 35s.; and for stevedores only, from 35s. to 50s. per cent. on the amount of wages paid. Some insurance offices will not undertake stevedores' risks. We have been informed by leading insurance officials that one large shipbuilding company on the Thames have had full employers' liability policies granted to them very recently at a premium of 5s. per cent. This is an extremely low rate, and it was refused by several of the insurance offices. About a year ago, or a little earlier, this shipbuilding company would have had to pay 30s. per cent. of the wages payable for the same risk to the then tariff insurance companies, and about 20s. nine months ago; whilst about half these rates would have been required for the same business by the non-tariff offices. As there is practically no limit to the amount of compensation to be paid in the event of injuries which involve permanent disablement, the Workmen's Compensation Act is very unsatisfactory to employers. It has been advocated that specific sums should be paid as compensation for specific injuries according to scale, so as to avoid accumulating liabilities and their dangers, and to correct the present inequalities of compensation payable to young and old in the event of loss of limbs and other serious personal injuries. It has often happened that there has been reasonable doubt as to whether the injury to a workman resulted from the negligence of the employer or of some person entrusted with superintendence and authority; and, as it is possible to recover full wages in regard to such injury under the Employers' Liability Act of 1880, with some amounts for medical fees, pain, and suffering, many men have claimed compensation under that statute instead of under the 1897 Act. In cases, however, when the injury has caused permanent, partial, or total disablement, claims have been made under the latter Act, because there is no limit to the time for which compensation can be recovered. The consequence is that in many instances the injured man has refused to accept half his weekly wages when offered by his employer in order to bring an action under the 1880 statute, or at common law, in the hope of being awarded heavy damages. It has been recommended that, to prevent money being wasted in legal proceedings which should have gone in compensation in consequence of claims being thus made, the law should be so altered that all claims for personal injury to workmen for accidents in the course of their employment should only be made under the Workmen's Compensation Act, and on the basis therein stated for ascertaining such compensation. Several important decisions have been pronounced in the Court of Appeal and the Court of Session of Scotland, respecting claims for compensation under the statute, of such great interest that we think it right to refer briefly to them. In the case of "Flowers *v.* Chambers" it was held that employment on a ship lying in a dock does not come within the Act, nor does employment on staging affixed to the outside of a ship, as decided in the case of "Durrie *v.* Warren & Co." It was held in the case of "Medd *v.* D. & C. MacIver" that iron gangway doors in the side of a ship through which cargo is taken and discharged are not plant used in the process of loading and unloading, and therefore a workman who was injured in closing these doors could not recover compensation for such injury. A dock, wharf, quay, warehouse, machinery, or plant does not come within section 7 of the Act, according to the judgment in the case of "Hall *v.* Snowden, Hubbard & Co., unless some provision of the Factory Acts is applied to it by the Factory and Workshop Act, 1895, and some such provision has been enforced with regard to it. It was held therefore that a wharf which abutted on the Regent's Canal, and which was used for loading mud or street sweepings into barges, and on which wharf there was no machinery used, was not a factory within the Workmen's Compensation Act. It was held in the case of "Chambers *v.* Whitehaven Harbour Commissioners" that employment on a hopper which is discharging one and half mile out at sea mud, which has been taken from a harbour by the workmen using a steam dredger, is not, within the meaning of this statute, employment on, in, or about an engineering work. A ship in dock was unloading by means of an hydraulic crane standing on the quay. It was decided in the case of "Woodham *v.* Atlantic Transport Co." that employment on the ship, at the end of the chain worked by the crane, was employment in, on, or about a factory, as the crane was machinery or plant used for unloading the ship to the quay. These six cases were decided by the Court of Appeal. The next three to which we will refer were adjudicated in the Court of Session of Scotland. In that of "the Aberdeen Steam Trawling and Fishing Co. *v.* Peters" it was held that machinery on board ship, although used in dock for loading or unloading, is not a factory within the meaning of the Factory and Workshop Act, 1895, and consequently not within the meaning of the Workmen's Compensation Act; and employment on this machinery is not an employment to which the latter statute applies. In the case of "Barclay, Curle & Co. *v.* McMillan" a workman was injured whilst working on a ship which had been removed from the shipbuilding yard to a dock about two miles away. In a claim under this Act it was held that the dock was "near" the yard, according to the interpretation of sub-section 3 of section 7 of the statute, and the Court awarded compensation. Lastly, in the case of "Jackson *v.* A. Rodger & Co.," a firm of shipbuilders, whose shipbuilding yard was at Port-Glasgow, contracted to build a ship and engines. After the ship had been constructed at Port-Glasgow, and launched there, she was sent from that place to the Cessnock Dock, Glasgow, between 15 and 20 miles away, to have her engines erected and fitted there by a firm of engineers with whom the shipbuilders had contracted for the supply of the engines. Whilst the ship was lying in this dock having her engines put in, a workman in the employment of the firm of engineers was injured whilst working at the undertaking. It was decided that under the Workmen's Compensation Act, section 7 (2), and the Factory and Workshop Act, 1895, section 23 (1), the shipbuilders were "occupiers" of the dock as a factory at the time when the accident occurred, and were consequently liable as the "undertakers" to pay compensation to the injured workman. The Lord Justice Clerk and Lord Trayner were of opinion that the place where the accident occurred was not a dock, river, or tidal water "near" the shipbuilders' yard within the meaning of section 7 (3), of the Workmen's Compensation Act. Another significant result of this Act is the non-employment of very many men over a certain age, and the discharge of many old workmen. The cause of this is said to be that the older the workman is the greater is his risk of having a serious accident. This system is mostly adopted by those employers who are uninsured, or join mutual associations. It is stated in the *Review* that this fact has probably caused "more heartburning amongst trade unionists than any other outcome of recent legislation, and it has been rightly argued that if the effect of the passing of the Act is to throw out of employment thousands of well-conducted and experienced workmen, merely because they have grown old in the service of their employers, then the sooner some well-conceived scheme of old-age pensions is started the better it will be for society at large." Insurance companies, on the other hand, beyond stipulating that reasonable precautions should be taken to guard against injuries to workmen by their employers, undertake the liability of the latter for their injuries without imposing any condition upon the employers as to whether their workmen should be young or old, hale or infirm; and this practice has no perceptible influence on premiums having regard to the great extent of accident insurance business.

THE present scarcity in the coal supplies is a serious matter for all steamship and engineering works proprietors. We think the present excessively inflated prices, due to exceptional demand, are not likely to last when the higher prices have produced the natural result of further supplies from all quarters. It must not be forgotten that Great Britain is not the only source of coal supply. We may not think much, and probably with justice, of the Belgian, French, or German coal, but it may not be generally known that already the United States are only about six million tons behind Great Britain as a coal-producing State, and so rapid has been the rate of increase that the United States will probably soon head the list. Within the last twenty years the output of the United States has doubled. The coal fields are also there yet almost virgin, so that the labour of getting is small, and it is credibly reported that coal is raised at the pit head in the United States for an average cost of 4s. 9d. per ton. This is less than the average rate in the United Kingdom or on the Continent. It is, therefore, the cheapest coal in the world except that of British India, which is computed to cost only 3s. 8d. at the pit. It is stated that West Virginia has 16,000 square miles of coal fields, as compared with 12,000 in Pennsylvania, although the output from the former field is as yet only one-tenth of the latter. Of last year's production 55 per cent. was from the Pennsylvania coal fields, consequently other fields in West Virginia, in

Illinois, in Ohio, and in Alabama, have hardly yet been touched. At present it is reported that considerable supplies are on their way from the United States to the Canaries, to Marseilles, Barcelona, the River Plate, Rio Janeiro, and the West Indies, which will soon remove the excessive demand upon the British supplies, and should soon bring prices down.

THE building of ice-breakers for Russia has now developed this class of vessel into a scientific success. We see that the *Odessa* has just arrived at the port of that name for service there to keep open the port for a period largely in excess of that usual, if not for the entire winter. More serious ice troubles are encountered in the Baltic than in the southern seas, and already the *Ermack*, the joint design of Vice-Admiral Makaroff and Mr. Arthur Gulston, of Newcastle-on-Tyne, has already made a name by her services in clearing navigable ways through the ice of the Baltic to the harbours of Cronstadt and Revel. She arrived at Cronstadt with the ice 18 in. thick, with a good deal of snow on the top, but the *Ermack* seems to steer and move as well in such ice as in open water. She steamed through this ice at 6½ knots up to the sea-wall, and entered the harbour through an entrance 95 ft. wide, the beam of the ship being 71 ft. She swung once inside the harbour, and one charge astern put her into her berth alongside the coal-store. Some manœuvres were made in ice of about 2 ft. to 3 ft. in thickness, and the turning circle was found to be about 600 ft., the length of the vessel being 305 ft. With 3,000 tons of coal on board, she has a displacement of 8,000 tons. At the stern are three screws, one in the centre and the other two one on either side, as in twin-screws. She has also a fourth screw forward in her bows, but this is not for propulsion so much as for the shattering of the ice and the formation of the stream under the hull, or away from the bows when going astern to shift loose pieces of ice which may have lodged under the ice field or under the vessel. Her engines can develop 8,000 H.P., and in open water she can make a speed of 15¼ knots. The whole of the propelling machinery is designed with 35 to 60 per cent. excess margin for strength above the requirements of Lloyd's and the Board of Trade; and her propellers are of nickel steel, and so strongly fashioned that they will stand the shock, as will also the engines, of being brought up suddenly by impact from the ice if she cannot break it. Snow on top of the ice seems to be the most difficult form of resistance for this vessel to overcome. If the ice is clear, her overhanging prow rides on the ice and breaks through by the sheer weight of the vessel, aided no doubt by the piercing or shattering action of the small forward propeller. The admiral has such confidence in his vessel that he has taken her during last summer for a pleasure trip through the Polar seas. He traversed 230 miles of Polar ice during five weeks, and he believes that such a vessel, or a pair of such vessels, adapted to aid one another stem to stern, might easily pierce to the North Pole in a summer season. She thinks nothing of ice 14 ft. thick. We have often said that it will require a marine engineer to reach the North Pole.

RECEIVER DROP IN MULTIPLE EXPANSION ENGINES.*

BY PROFESSOR R. L. WEIGHTON, M.A., VICE-PRESIDENT.

THE object of this paper is to give and explain the results obtained from certain trials recently completed on the experimental engines at the College of Science, Newcastle-upon-Tyne. These trials were made with a view to determine the most economical point of steam cut-off in the larger cylinders of multiple-expansion engines—that is to say, in the low pressure cylinder of double expansion, in the intermediate and low pressure cylinders of triple expansion, and in the two intermediate and low pressure cylinders of quadruple-expansion engines.

The importance of this question was brought into view very early in the course of the trials generally with those engines. In the last paper which the writer had the privilege of bringing before the Institution the matter was referred to as requiring elucidation.†

As far as the writer is aware, there has hitherto been no experimental determination of the point in question. During the course of engine trials having various objects in view, it very soon became evident that the point of cut-off in the larger cylinders had a considerable effect upon the results obtained, economical and otherwise. In order that this disturbing cause should be eliminated from the results, it appeared that prior to any further experiments it would be necessary to determine what *was* the best point of cut-off in each cylinder. Independent of this, however, it was also obvious that the question had in itself an important bearing upon practice, from the point of view of engine design, proportions, and working generally. For this twofold reason the several series of trials here recorded were undertaken.

The specific object of the trials was to determine *the* receiver drop (often referred to as free or intermediate expansion) between any two cylinders, with which was associated maximum economy, and incidentally to discover, in addition, the general effects of varying amounts of receiver drop in given conditions.

The principal results are tabulated in Tables I. to V., and are graphically recorded on Diagrams I. to X.

Table I. refers to results obtained from triple-expansion engines having cylinders 7 in., 15½ in., and 23 in. diameter. The stroke in all cases is 18 in. From this table it will be seen that the method adopted was to change or vary only one condition at a time, viz., the cut-off, first in the intermediate pressure and next in the low-pressure cylinder, all the other conditions being kept as nearly as possible constant and unvarying throughout the trials of a series.

During the first six trials the intermediate pressure cut-off was varied, and during the second six the low pressure cut-off was the condition which was varied. In Diagram I. the results of Table I. are recorded. The base line represents in inches the point of cut-off in intermediate pressure and in low pressure respectively. Ordinates represent: (1) Water used per hour. (2) Brake horse power. (3) Water used per brake horse power per hour.

The water used per hour at constant revolutions—in these tables 140 revolutions per minute are chosen throughout—lies in a straight line, marked "W" on the diagram. This line shows that the water consumption at constant revolutions increases with the cut-off in the larger cylinders, and that the rate of increase is much greater when the intermediate pressure cut-off is made later than when the low pressure cut-off is made later. A notable exception to this occurs when the jackets are in use, Diagram VI., in which case the consumption is constant at all cut-offs, as would naturally be expected from the temperature-equalising effect of the jackets. The brake horse power lies in a curve, which curve attains in most of the trials a maximum height, and then falls as the cut-off is further increased. The water per brake horse power, being the straight line ordinates divided by the curve ordinates, lies also in a curve. The lowest point of this curve indicates the cut-off at which maximum economy of water per horse power occurs. In Diagram I. the maximum economy cut-off in the intermediate pressure cylinder is about 6⅝ in. and in the low-pressure about 10½ in.

---

* Read before the North-East Coast Institution of Engineers and Shipbuilders, in Newcastle-on-Tyne, on January 19th, 1900.

† See "Transactions of the North-East Coast Institution of Engineers and Shipbuilders," vol. xiii., page 88.

Table II. and Diagram II. refer to cylinders 7 in., 10½ in., and 23 in. diameter, and here it will be noticed that the best cut-offs occur in the intermediate pressure cylinder at 11 in., and in the low pressure at about 6⅝ in.

Diagram III. refers to cylinders 10½ in., 15½ in., and 23 in. diameter, and shows the best cut-offs in both intermediate pressure and low pressure cylinders to be about 10¾ in. In this diagram and the next one let it be noted that the boiler pressure is 120 lbs. per square inch as against 210 lbs. in the two previous diagrams.

Diagram IV. shows results under exactly the same conditions as No. III., with the single exception that the high pressure cut-off is 9 in., instead of 6 in., as in No. III. This series was made to discover what influence—if any—the total number of expansions had upon the maximum economy cut-offs in the larger cylinders of the engines. It will be seen that the best cut-off in Diagram IV. for both cylinders is about 10¾ in., which agrees with the result of Diagram III. The high pressure cut-off point has therefore no apparent effect, this is confirmed in Diagram V. for quadruples, referred to further on. Neither has the boiler pressure any effect upon the maximum economy cut-off, as is evidenced by a comparison of the cut-offs in low pressure and intermediate pressure of Diagrams I. and II. respectively with the cut-offs in intermediate pressure and low pressure of Diagrams III. and IV. These cut-ofts, taking them in the order mentioned, are 10½ in., 11in., 10¾ in., and 10¾ in., the cylinder ratios being in all these cases practically the same, viz., 2·195 and 2·296.

Diagram V. gives the curves of water used per brake horse-power per hour for quadruples having cylinders 7 in., 10½ in., 15½ in., and 23 in. diameter, at various degrees of total expansion of the steam, ranging from that corresponding to a high pressure cut-off of 3 in., down to a cut-off of 12 in.

From this diagram two conclusions may be drawn: first, that degree of total expansion does not affect materially the point of maximum-economy cut-off in the larger cylinders, thus corroborating the comparison of Nos. III. and IV.; and second, that the best points of cut-off in the larger cylinders of quadruples

List of Tables and Diagrams.

Table.	Diagram.	Cylinders Ins.	Ins.	Ins.	Ins.	Pressure lbs.		
I.	I.	7	15½	23	—	210	H.P. cut-off 12"	
II.	II.	7	10½	23	—	210	H.P. cut-off 12"	
—	III.	10½	15½	23	—	120	H.P. cut-off 6"	
—	IV.	10½	15½	23	—	120	H.P. cut-off 9"	
—	V.	7	10½	15½	23	200	H.P. cut-offs 3", 4½", 6", 12"	
III.	VI.	7	10½	23	—	200	H.P. cut off 10"	Jacket trials.
IV.	VII.	7	10½	23	—	200	H.P. cut-off 10"	Receiver capacity trials.
V.	VIII.	7	23	—	—	200	H.P. cut-off 10"	Compound trials
—	IX.	Receiver drop of maximum economy						
—	X.	Cut-off of maximum economy.						
—	XI.	Expanded cards of No. 1, Table I.						
—	XII.	" " No. 5, " I.						
—	XIII.	" " No. 5, " II.						
—	XIV.	" " No. 9, " II.						
—	XV.	" " No. 10, " II.						

Table I. (see Diagram I.).

Cylinders, 7 inches, 15½ inches, 23 inches, by 18 inches stroke. Intended boiler pressure, 210 lbs. Jacket steam shut off. Receivers continuously drained. Crank sequence H.I.L.

	Cut-off in Cylinders (Inches). H.	I.	L.	H.P. Steam-chest Pressure	Revolutions per Minute.	M.P. reduced to L.P.	I.H.P.	B.H.P. Brake Horse-power	Water used per Hour.	B.H.P. at 140 Revolutions	Water per Hour at 140 Revolutions	Water per B.H.P. per Hour.
				Lbs. per Sq. In.		Lbs. per Sq. In.			Lbs.		Lbs.	Lbs.
I.P. cut-off varied	12	12	12	201	144·2	28·2	152·8	141·6	2,263	137·4	2,197	15·98
	12	10½	12	201	143·6	28·97	156	141·8	2,231	138·3	2,175	15·72
	12	9	12	200	148·1	28·9	161·2	145·9	2,258	137·9	2,134	15·47
	12	7½	12	201	147	28·76	158·8	144·5	2,209	137·6	2,104	15·28
	12	6	12	201·5	144·2	28·1	153·8	138·9	2,112	134·8	2,050	15·2
	12	4½	12	202·7	137·27	27·61	142·4	126	2,005	128·6	2,045	15·9
L.P. cut-off varied	12	6	13½	201·7	144·63	28·97	157·3	141·7	2,168	137·2	2,096	15·28
	12	6	12	201	144·3	28·63	155·2	141·9	2,148	137·7	2,084	15·13
	12	6	10½	200·8	146	28·89	158·4	143·5	2,169	137·6	2,080	15·11
	12	6	10½	203	144·37	29·06	157·4	141·6	2,151	137·4	2,086	15·19
	12	6	9	202	146·8	29·3	161·5	143·8	2,177	137·2	2,076	15·13
	12	6	7½	201·8	144·6	29·25	159	139·1	2,145	134·8	2,077	15·42

Table II (see Diagram II.).

Cylinders, 7 inches, 10½ inches, 23 inches, by 18 inches stroke. Intended boiler pressure, 210 lbs. Jacket steam shut off. Receivers continuously drained. Crank sequence H.I.L.

	Cut-off in Cylinders (Inches) H.	I.	L.	H.P. Steam chest Pressure	Revolutions per Minute	M.P. reduced to L.P.	I.H.P.	B.H.P. Brake Horse-power.	Water used per Hour	B.H.P. at 140 Revolutions	Water per Hour at 140 Revolutions	Water per B.H.P. per Hour
				Lbs. per Sq. In.		Lbs. per Sq. In.			Lbs.		Lbs.	Lbs.
I.P. cut-off varied	12	13½	10½	198·5	144·8	27·57	149·5	137·5	2,102	133	2,033	15·29
	12	12	10½	200	145·4	27·88	152·1	136·4	2,087	131·3	2,009	15·3
	12	10½	10½	202	142·17	27·62	147·6	132·2	2,026	130·2	1,995	15·33
	12	9	10½	201	139·6	26·96	141·2	126·3	1,938	126·6	1,943	15·34
L.P. cut-off varied	12	11½	12	201	136·06	27·06	138·3	124·7	1,975	128·4	2,033	15·82
	12	11½	10½	201	137·9	27·57	142·6	127·6	1,996	129·6	2,026	15·64
	12	11½	9	202	139·63	27·94	146·5	131·6	2,016	131·9	2,021	15·32
	12	11½	7½	202	141·2	28·48	151	135·6	2,024	134·4	2,006	14·92
	12	11½	6	202	142·47	28·55	152·7	135·3	2,028	135·8	1,992	14·67
	12	11½	4½	200	139·6	27·43	143·8	131·8	2,004	132·2	2,010	15·2

Table III (see Diagram VI.)

Cylinders, 7 inches, 10½ inches, 23 inches, by 18 inches stroke. Intended boiler pressure = 200 lbs. Steam on jackets. Receivers not drained. Crank sequence H.I.L.

Cut-off in Cylinders (Inches) H.	I.	L.	H.P. Steam-chest Pressure	Revolutions per Minute.	M.P. reduced to L.P.	I.H.P.	B.H.P. Brake Horse power	Water used per Hour	B.H.P. at 140 Revolutions	Water per Hour at 140 Revolutions	Water per B.H.P. per Hour
			Lbs. per Sq. In.		Lbs. per Sq. In.			Lbs.		Lbs.	Lbs.
10	10½	10	197	137·34	29	149·9	130·5	2,013·5	133	2,053	15·43
10	10½	8	198	146·7	28·91	159·1	144	2,151	135·4	2,052	15·15
10	10½	6	196	142·55	29·93	160	141·2	2,033	138·6	1,997	14·4
10	10½	6	197	135·5	29·02	147·5	131·6	1,971·2	136	2,037	14·97
10	10½	4	200	140·8	29·18	154·1	136·3	2,064·4	135·6	2,052	15·13

Table IV. (see Diagram VII.).

Cylinders, 7 inches, 10½ inches, 23 inches, by 18 inches stroke. Intended boiler pressure = 200 lbs. I.P. receiver doubled in capacity as compared with Table II. Jacket steam shut off. Receivers continuously drained. Crank sequence H.I.L.

Cut-off in Cylinders. (Inches). H.	I.	L.	H.P. Steam-chest Pressure.	Revolutions per Minute.	M.P. reduced to L.P.	I.H.P.	B.H.P.	Water used per Hour.	B.H.P. at 140 Revolutions	Water per Hour at 140 Revolutions.	Water per B.H.P. per Hour
			Lbs. per Sq. In.		Lbs. per Sq. In.			Lbs.		Lbs.	Lbs.
10	13½	6½	197·5	139	25·86	134·8	123·5	1,963·6	124·4	1,979	15·91
10	12	6½	197·5	139·53	25·82	135·2	124·9	1,967·3	125·4	1,973	15·74
10	10	6½	197	138·23	25·99	134·8	121·8	1,885	123·4	1,909	15·46
10	8	6½	198	136·14	25·74	131·4	117·7	1,815·6	121	1,867	15·43

Note.—Vacuum was exceptionally low for trials on Table IV

Table V. (see Diagram VIII.)

Cylinders, 7 inches, 23 inches, by 18 inches stroke. Intended boiler pressure, 200 lbs. Jacket steam shut off. Receivers continuously drained. Cranks at 90 degrees. L.P. leading.

Cut-off in Cylinders (Inches). H.	L.	H.P. Steam-chest Pressure	Revolutions per Minute.	M.P. reduced to L.P.	I.H.P.	B.H.P. Brake Horse-power.	Water used per Hour	B.H.P. at 140 Revolutions.	Water per Hour at 140 Revolutions	Water per B.H.P. per Hour.
		Lbs. per Sq. In.		Lbs. per Sq. In.			Lbs.		Lbs.	Lbs.
10	7½	197	127·9	22·52	108	101·5	1,970	111·1	2,156	19·4
10	6	199	132·2	23·73	117·7	108·3	2,000	114·7	2,118	18·46
10	4½	198	131·23	24·15	118·9	107·6	1,950·6	114·8	2,081	18·13
10	3	199	130·7	21·63	106·1	103·2	1,874	110·5	2,007	18·16

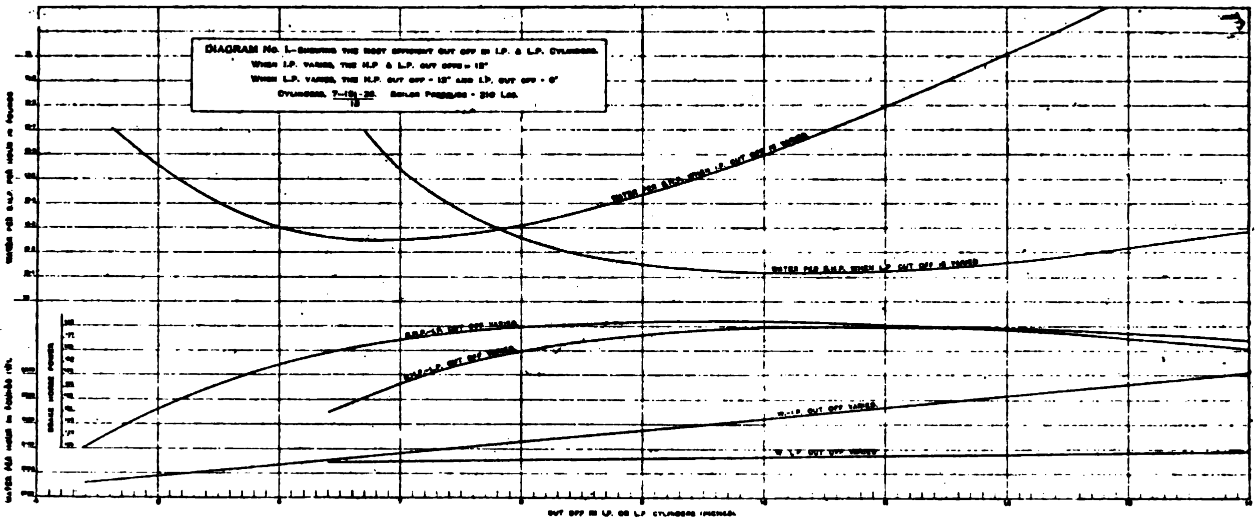


DIAGRAM No. I.—Showing the Most Efficient Cut Off in I.P. & L.P. Cylinders.
When I.P. varies, the H.P. & L.P. cut offs = 12"
When L.P. varies, the H.P. cut off = 12" and I.P. cut off = 6"
Cylinders, $\frac{7-10\frac{1}{2}-20}{15}$. Boiler Pressure = 210 Lbs.

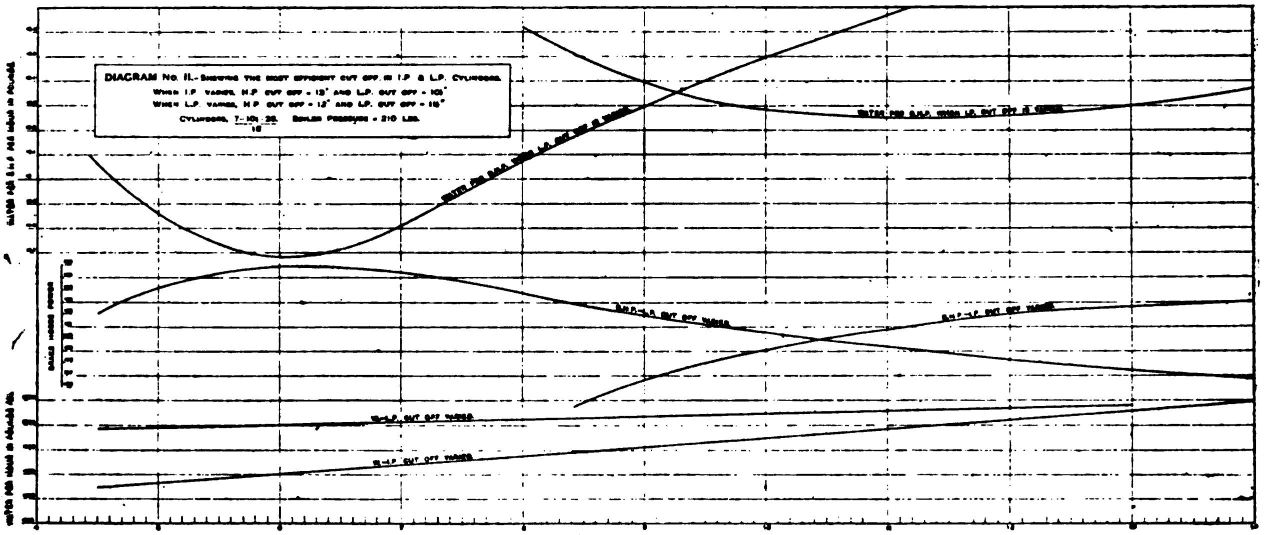


DIAGRAM No. II.—Showing the Most Efficient Cut Off in I.P. & L.P. Cylinders.
When I.P. varies, H.P. cut off = 12" and L.P. cut off = 10½"
When L.P. varies, H.P. cut off = 12" and I.P. cut off = 10"
Cylinders, $\frac{7-10\frac{1}{2}-20}{15}$. Boiler Pressure = 210 Lbs.

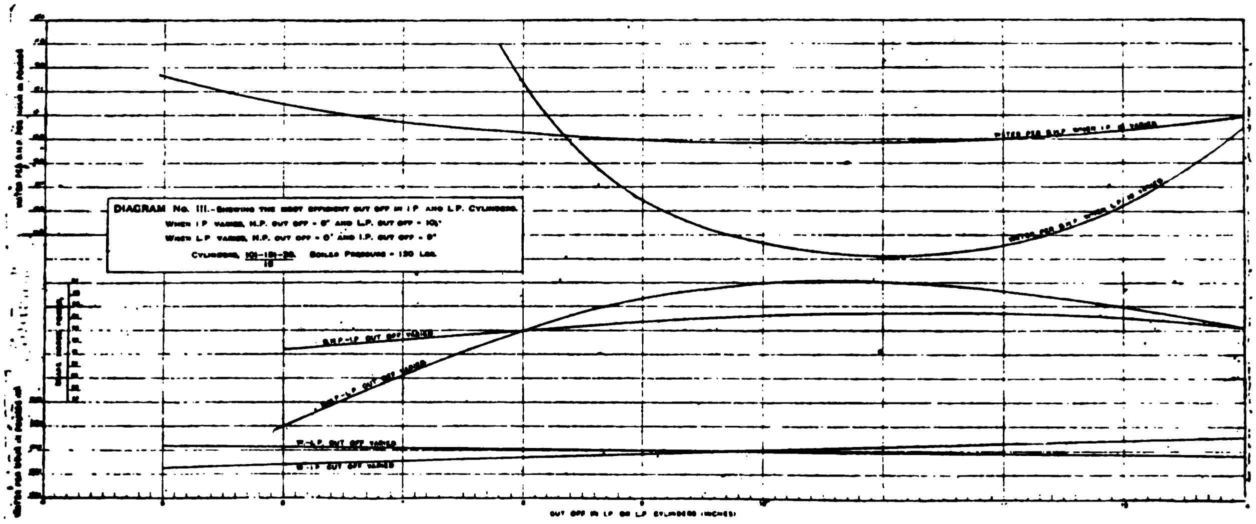


DIAGRAM No. III.—Showing the Most Efficient Cut Off in I.P. and L.P. Cylinders.
When I.P. varies, H.P. cut off = 6" and L.P. cut off = 10½"
When L.P. varies, H.P. cut off = 6" and I.P. cut off = 6"
Cylinders, $\frac{10\frac{1}{2}-15\frac{1}{2}-28}{15}$. Boiler Pressure = 120 Lbs.

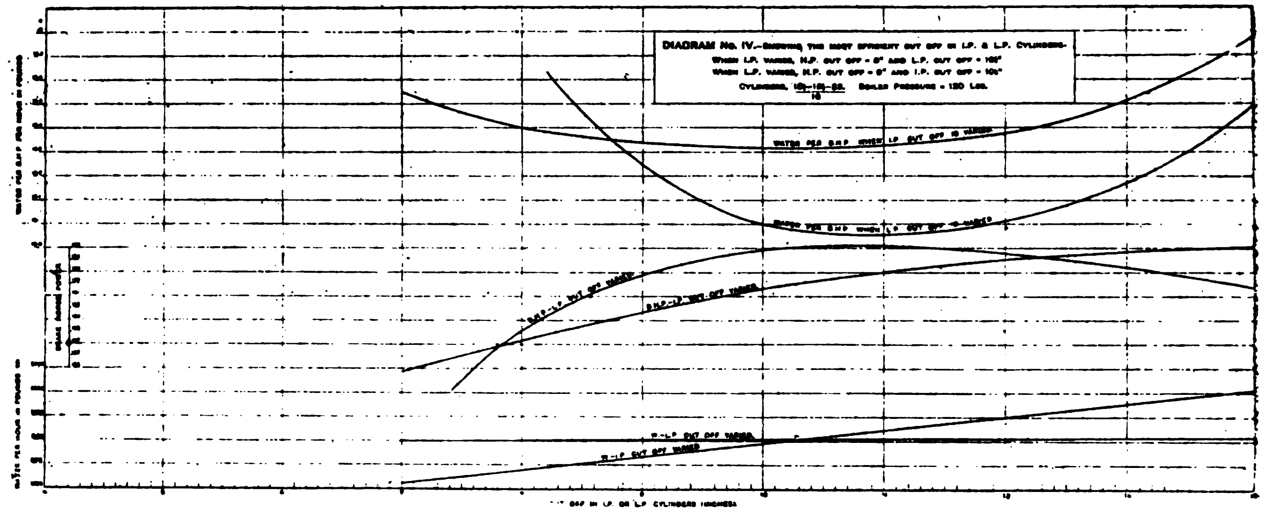


DIAGRAM No. IV.—Shewing the most efficient cut off in I.P. & L.P. Cylinders.
When I.P. varied, H.P. cut off = 8" and L.P. cut off = 10½"
When L.P. varied, H.P. cut off = 8" and I.P. cut off = 10½"
Cylinders, 10½–15½–22 / 16. Boiler Pressure = 120 Lbs.
Water per B.H.P. when I.P. cut off is varied
Water per B.H.P. when L.P. cut off is varied
B.H.P.—I.P. cut off varied
B.H.P.—L.P. cut off varied
W—L.P. cut off varied
W—I.P. cut off varied
Water per B.H.P. per hour in pounds
Brake Horse Power
Water per hour in pounds
Cut off in I.P. or L.P. cylinders (inches)

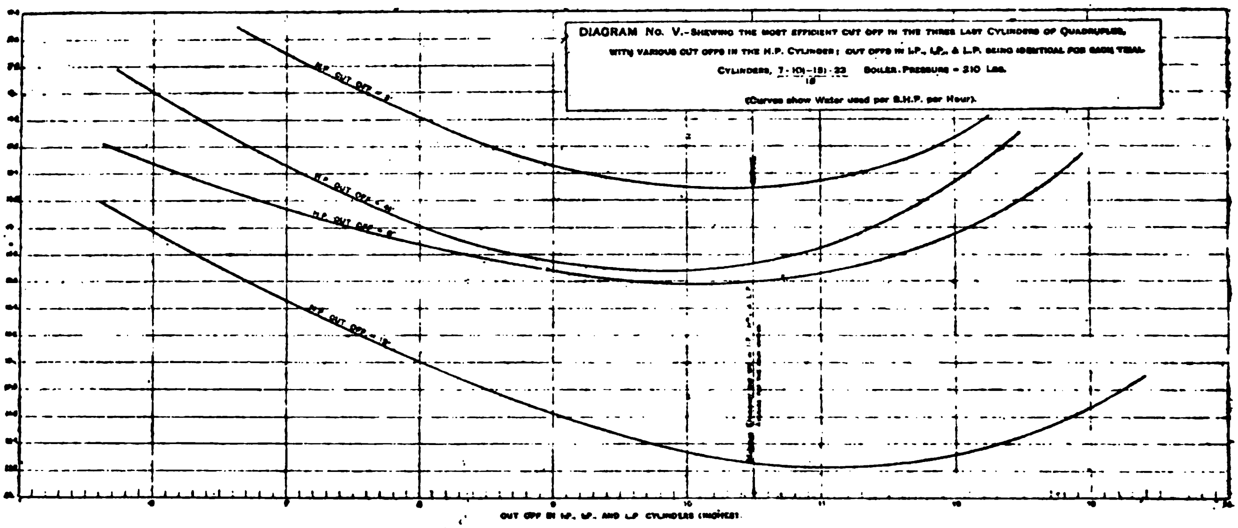


DIAGRAM No. V.—Shewing the most efficient cut off in the three last Cylinders of Quadruples,
with various cut offs in the H.P. Cylinder; cut offs in I.P., I.P., & L.P. being identical for each trial.
Cylinders, 7·10½–15½·22 / 16 Boiler Pressure = 210 Lbs.
(Curves show Water used per B.H.P. per Hour).
H.P. cut off = 5"
H.P. cut off = 6½"
H.P. cut off = 8"
H.P. cut off = 10"
Water per B.H.P. per hour in pounds
Cut off in I.P., I.P. and L.P. cylinders (inches)

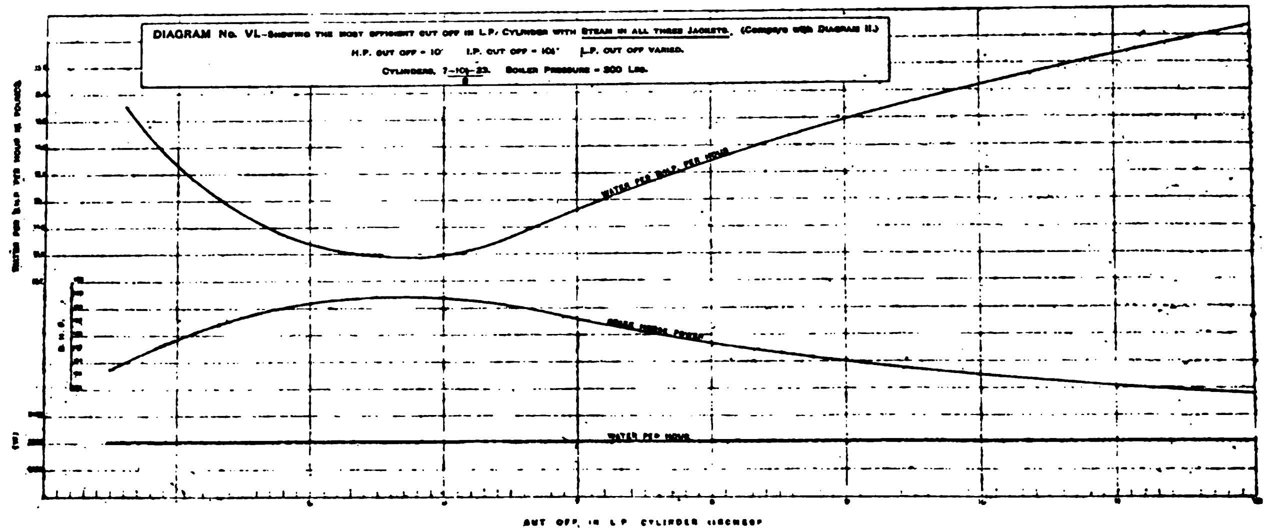


DIAGRAM No. VI.—Shewing the most efficient cut off in L.P. Cylinder with Steam in all three Jackets. (Compare with Diagram II.)
H.P. cut off = 10" I.P. cut off = 10½" L.P. cut off varied.
Cylinders, 7–10½–23 / 8. Boiler Pressure = 200 Lbs.
Water per B.H.P. per hour
Brake Horse Power
Water per hour
B.H.P.
Water per B.H.P. per hour in pounds
Cut off in L.P. cylinder (inches)

are governed by the same influences as in triples. The ratios of the quadruple cylinders are practically all the same, and are identical with the ratios of Diagrams III. and IV. The best cut-off is about 10½ in. on the average. This is to be compared with the best cut-off in Diagrams I., II., III., and IV. for the same cylinder ratio.

Owing to the space they would occupy, it has not been thought desirable to give tables for all the diagrams. Those corresponding to Diagrams III., IV., and V. are therefore omitted.

All the trials so far referred to were made without jacket steam. In order to determine what influence jackets might have on the results, a series of trials were made, the results of which are given in Table III. and Diagram VI. The curves of this diagram are to be compared with those of Diagram II. when the low pressure cut-off was varied.

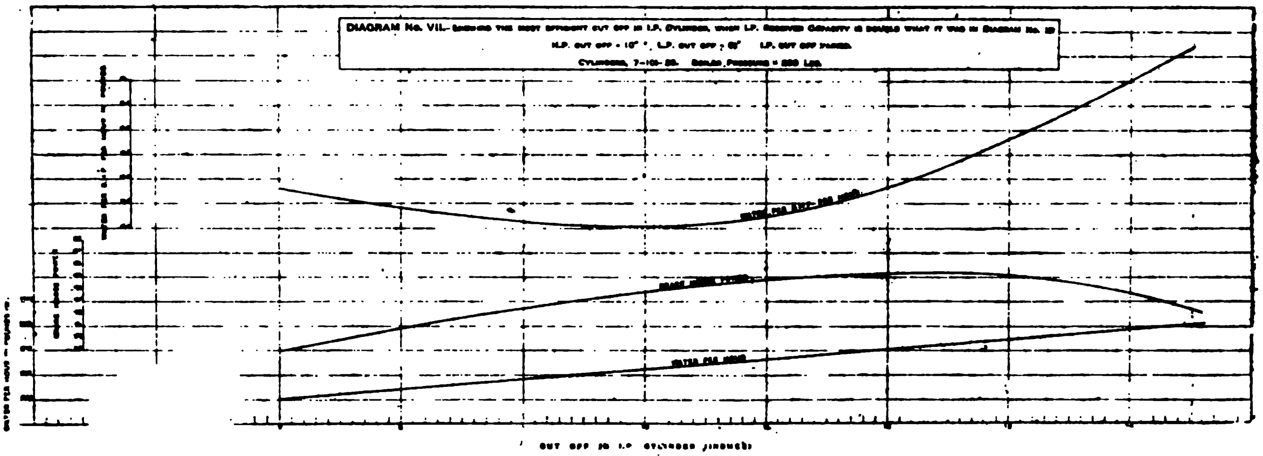
The best cut-off in the low-pressure cylinder with steam in the jackets is about 5¾ in., as against 6⅜ in. without jacket steam. The legitimate conclusion seems to be that jackets have no material effect upon the cut-off of maximum economy.

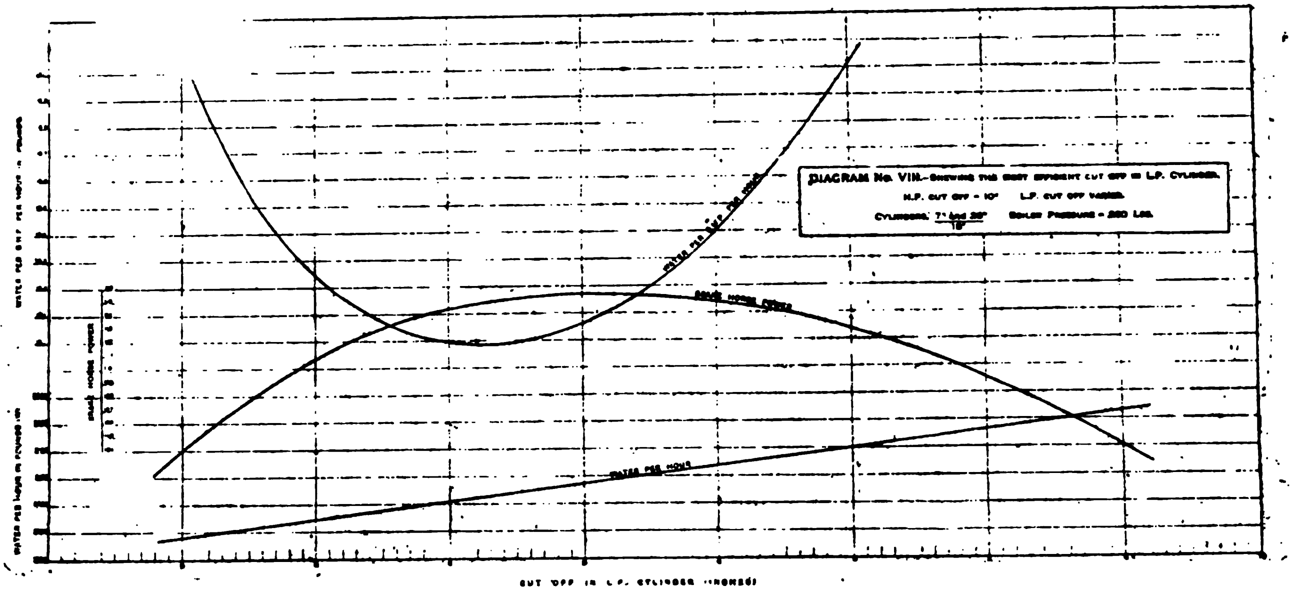
Table IV. and Diagram VII. show results of trials made with the intermediate-pressure receiver capacity doubled as compared with its capacity under the conditions of Diagram II. An inspection of Diagram VII. shows that the best cut-off in the intermediate-pressure cylinder is practically identical with that of Diagram II. It may therefore be concluded that variation in receiver capacity—at least within limits generally possible in practice—has no sensible effect upon the maximum economy cut-off in the larger cylinders.

It was not thought necessary in the two last series of trials to duplicate the experiments by varying the cut-off in the other cylinder, as had been done in all the previous trials.

Table V. and Diagram VIII. give results from the engines arranged as double expansion or compound engines, with cylinders 7 in. and 23 in. diameter, corresponding to a cylinder ratio of 11. In this case maximum economy cut-off in the low pressure occurs very early in the stroke, viz., at about 4⅜ in.

Of course the cylinder ratios in these trials have been purposely chosen as different from each other as the design of the engines allowed, in order to show as definitely as possible the connection which subsists between cylinder ratio and the cut-off corresponding to highest efficiency. This paper does not profess to deal with the entirely distinct questions of the best cylinder ratios or the best total number of expansions for steam of different pressures. The particular values of the cylinder ratios used in these trials are therefore of no economic significance, except in so far as they are associated with the best cut-offs in the larger cylinders of the engines. And it is obvious that the more widely the experimental ratios differ from each other the more clearly will their special connection with the point we are in search of be indicated. Hence the reason for the trials of Diagram VIII., and such an unusual ratio as 11 to 1.





An examination of the whole of these results shows that the one and only factor which affects materially the cut-off of maximum economy in any one of the cylinders following the high pressure cylinder is the ratio between the cylinder in question and the immediately preceding cylinder. In other words, the ratio between any two successive cylinders is the one factor which determines the point of of maximum economy cut-off in the second of the two cylinders.

In the subjoined table, column II. sums up the results from all the trials, in the shape of the best cut-off for each value of cylinder ratio (R). The figures in column III. represent maximum economy ratios of free expansion in the receivers.

I. Any Cylinder Capacity. / Preceding Cylinder Capacity. R.	II. Best Cut-off in Inches of Stroke.	III $R \times \frac{\text{Best Cut-off}}{\text{Stroke.}}$
2·195	$10\frac{1}{2}$	1·28
2·195	$10\frac{1}{2}$	1·28
2·195	$10\frac{1}{2}$	1·28
2·195	$10\frac{3}{4}$	1·31
2·195	$10\frac{3}{4}$	1·31
2·296	10	1·275
2·296	11	1·4
4·86	$6\frac{3}{8}$	1·72
5·04	$6\frac{5}{8}$	1·85
11·00	$4\frac{3}{8}$	2·67

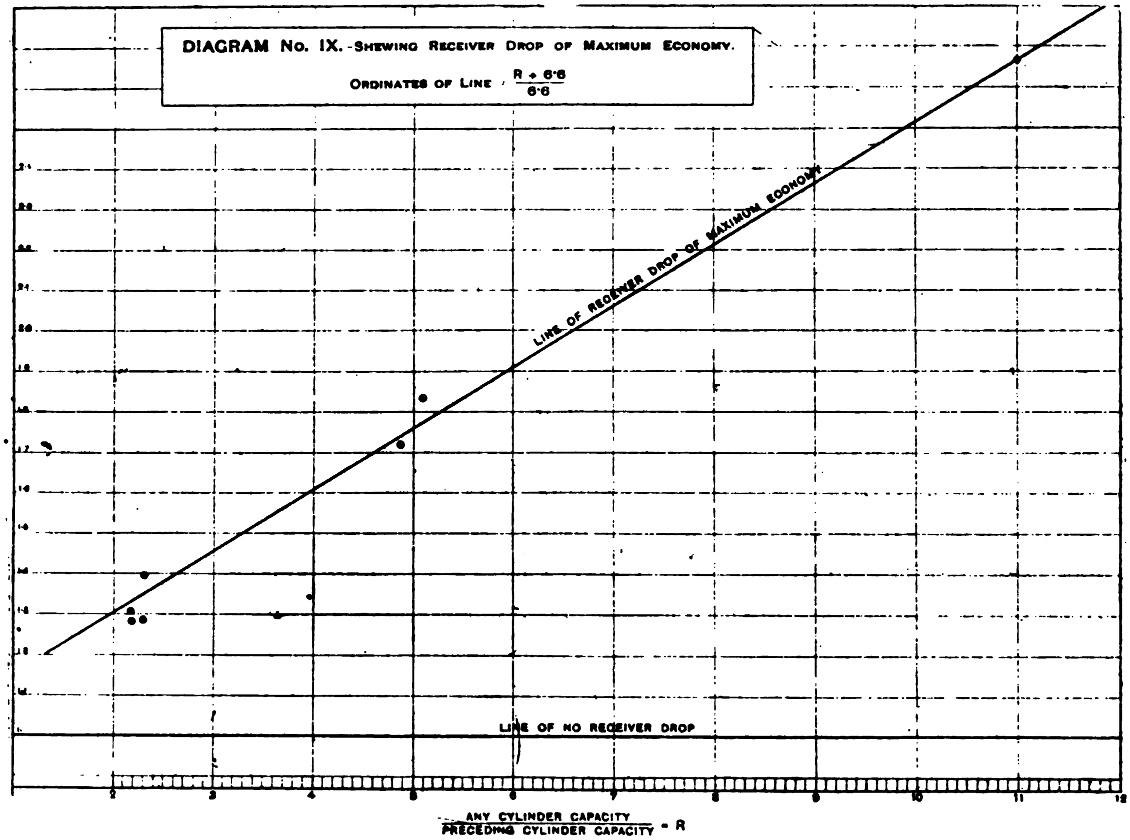
These figures are therefore proportional to the receiver drop, with which is associated maximum economy in the several cases. The values in column III., when plotted to a base of R, as in Diagram IX., will be seen to lie practically in a straight line. The equation to this line will be found to be as follows:—

$$R \times \frac{\text{Best cut-off}}{\text{Stroke}} = \frac{R + 6\cdot 6}{6\cdot 6}.$$

From this follows the best cut-off in terms of R, viz.:—

$$\frac{\text{Best cut-off}}{\text{Stroke}} = \frac{R + 6\cdot 6}{6\cdot 6\,R}.$$

This last expression is an equation to a curve which is plotted in Diagram X., and from which diagram the best cut-off for any cylinder ratio can be read off by inspection in fractions of the stroke. On the same diagram is shown, merely for comparison, the curve of cut-off for no receiver drop.

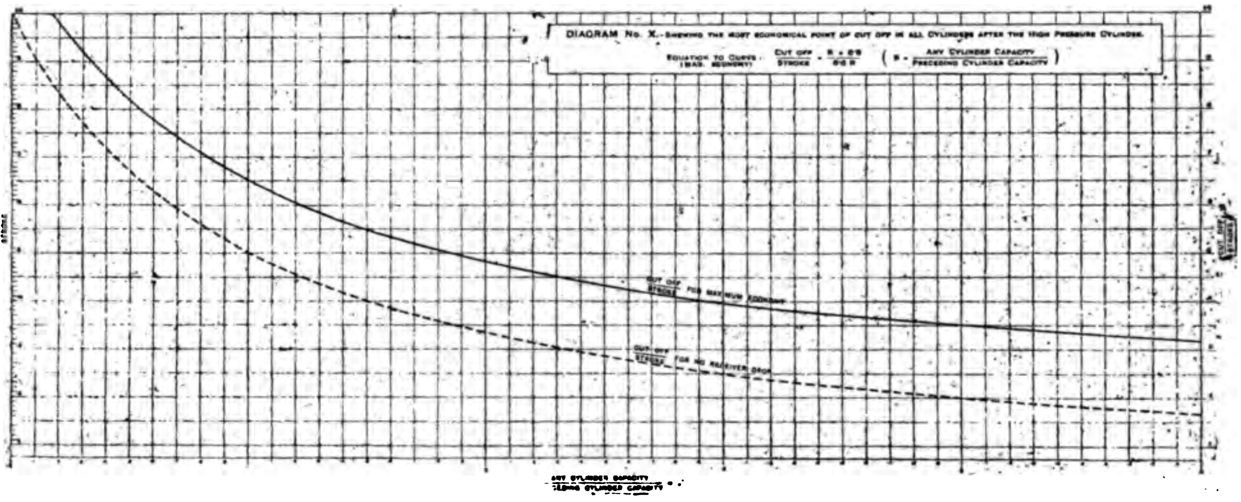


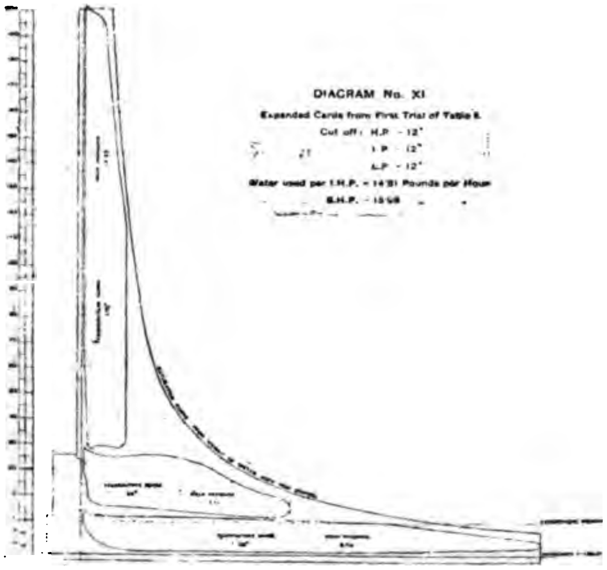
In the tabulated values of R, allowance is made for clearances, and also for areas of piston rods. By "best cut-off" is meant the particular cut-off in the larger cylinders at which maximum economy occurs.

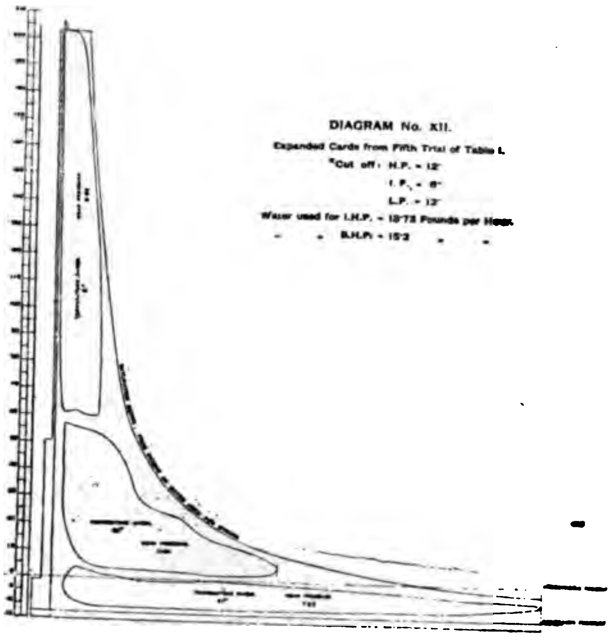
It was very noticeable in the working of the engines that late cut-offs were distinctly conducive to smoothness of running, uniformity of turning moment, and durability of bearings; whilst early cut-offs were always accompanied by a comparative absence of these desirable qualities. With early cut-off in any cylinder the engines always appeared to labour heavily, and to work with jars and thumps, which symptoms entirely disappeared when the cut-off was increased. Owing to the absence of a fly-wheel any tendency towards inequality of turning was rendered very evident, and was, in addition, automatically recorded on the brake diagram.

Moreover, late cut-offs, being associated with smallness of valve travel, and all that this entails, are *constructively* preferable to early cut-offs. Late cut-offs also favour handiness in starting and reversing. From many points of view, therefore, it follows that late cut-offs are greatly preferable to early cut-offs. But, as shown by Diagram X., late cut-offs, in the larger cylinders at least, can only be adopted with economy when the cylinder ratios are small. This leads to the conclusion that, other things being equal, the most satisfactory engine as regards smoothness of working, durability, and economy, in so far as affected by receiver drop, will be that engine which attains a given degree of total expansion with the smallest cylinder ratios, or at least with ratios not exceeding a certain limit.

It was necessary to bear in mind that, although results are here given from double, triple, and quadruple expansion, no valid comparison can—on the results as they now stand—be instituted between these three methods of working. To institute such a comparison all the different results must be reduced to a common basis as regards vacuum, barometer, steam pressure, &c., and this has not been done in the paper because not necessary for the purposes in view.







In Diagrams XI. to XV. inclusive, are given some samples of expanded indicator cards. These particular cards have been selected from a very large number, in order to show the effects, by contrast, of extreme variations in cut-off. The notes on the diagrams are sufficiently explanatory without further reference. The "mean pressure" on each card is that reduced to the low pressure cylinder. It therefore represents comparative power in the several cylinders. It will be noticed that there is no marked evidence that maximum economy is associated either with equality of power or with equality of temperature ranges in the several cylinders.

Deductions from the Results.—The following is a summary of the more important of the deductions which may be made from the results of the trials:—

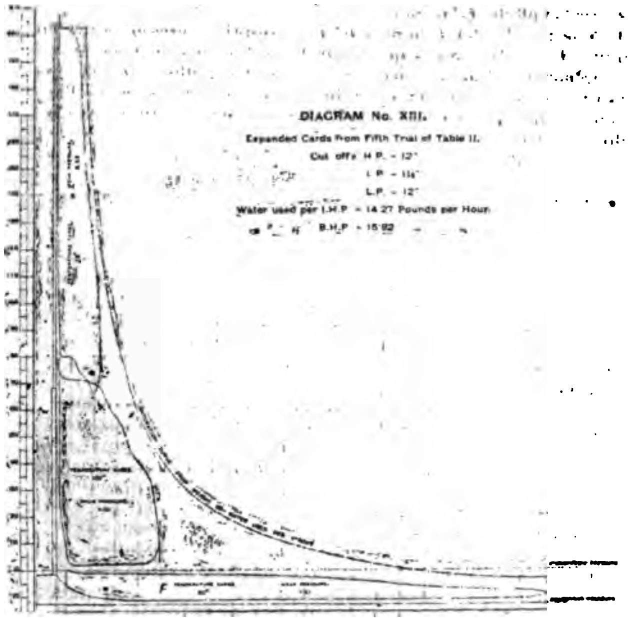
1. For maximum economy of consumption, steam must be cut off at a certain point of the stroke in the larger cylinders of multiple-expansion engines. For any given cylinder this point depends solely upon the ratio between the capacities of that cylinder and the preceding cylinder (R), and is expressed as follows, viz.:—

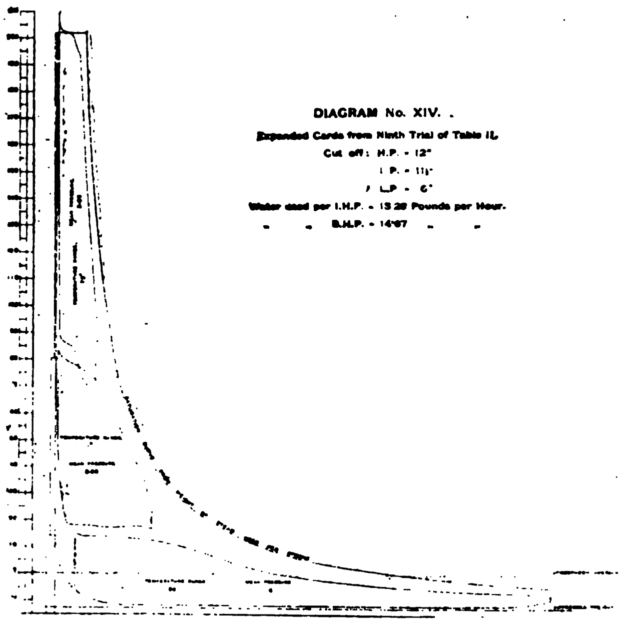
$$\frac{\text{Maximum economy cut-off}}{\text{stroke}} = \frac{R + 6{\cdot}6}{6{\cdot}6\,R}.$$

This is the principal and most important conclusion deduced from the trials, and—as already explained—is embodied in Diagram X.

2. It follows from No. 1 that the cut-off in the larger cylinders, once fixed, should never be altered, whatever may be the cut-off in the high pressure cylinder, or the steam pressure employed. This means that automatic expansion governors, or linking-up gear, should act upon the high pressure cylinder only, if maximum economy at all powers is to be preserved.

3. The cut-off in the larger cylinders affects materially the total horse power developed by the engines. As regards the low pressure cylinder of triples, and the second intermediate

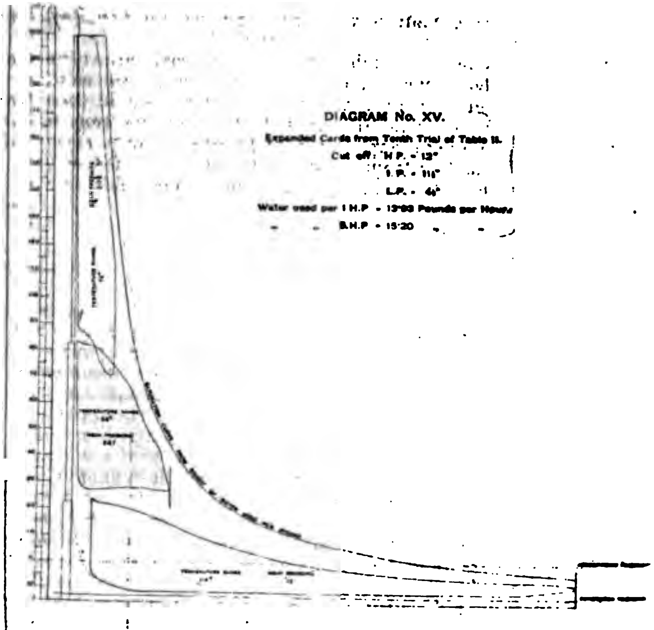




and low pressure cylinders of quadruples, maximum power cut-off in these cylinders coincides with the cut-off of maximum economy. As regards the second cylinder of triples and quadruples, maximum power cut-off is very considerably later than that of maximum economy. In compounds the maximum power cut-off in the low pressure cylinder is only slightly later than that of maximum economy. See Diagrams I. to VIII.

4. When cylinder ratio (R) is small—say from 2 to 2·5—the cut-off in the larger cylinders may be varied considerably from that corresponding to maximum economy, without any appreciable fall in economy. But when R is large, there is no such permissible deviation without entailing as a consequence a fall in efficiency.

5. With given efficiency in receiver drop, smallness of cylinder ratio is conducive to smoothness of working, uniformity of turning, durability, handiness in starting and reversing, and compactness of design.



MOSSBERG'S PATENT ROLLER THRUST BLOCK

In our issue of October last year we gave a description and illustrations of the patent roller bearing of the Mossberg Roller Bearings, Limited, of 68 Victoria Street, London, S.W., which clearly set forth the general principles and arrangement of parts which obtain in these devices. We have now the pleasure of illustrating the roller bearing in the form of a thrust block for a propeller shaft. By reference to the adjoining diagram it will be seen that Fig. 1 is a perspective view of the thrust block complete, whilst Fig. 2 is a similar view with the cover over the roller elements removed.

The block generally is in the main casting similar to those now used with horseshoe collars, the central portion or recess forming an oil bath. This main casting carries a cylindrical bearing at the fore and aft ends, within which the shaft is journalled. The shaft carries centrally disposed the live roller path collar, a path being arranged upon both faces. This collar is in halves and bolted together by through bolts around the shaft.

The stationary roller paths are arranged one on each cylindrical bearing; these are also in halves. Between the pairs of live and stationary paths rings carrying the rollers are inserted. These rollers are conical, so that the peripheral speed along their length is proportional to the distance at which any particular part of the roller is situated from the centre of the shaft. These rings are also in halves, and are constructed to hold the rollers in place when the parts of the thrust bearing are being assembled.

The stationary paths are adjusted and set up in proper position relative to the live paths by means of set screws, two of which are arranged at each end of the main casting.

As an interesting fact relative to this particular class of bearing, we illustrate in Fig. 3 one of the Mossberg patent end thrust bearings loaded with 8,000 lbs., which, on actual test, we understand, only required a force of 20 lbs. at a radius of 10½ in. to overcome the friction due to such load, whilst with a plain bearing 400 lbs. pull was required. We presume this ratio of 20 to 1 was without any lubricant between the surfaces, as we have found, from actual experiments of a similar nature, that with lubricant the ratio was about 7 to 1.

We consider that any advance in the reduction of waste energy by friction is an important gain, and has an appreciable effect upon the final result, for by reason of the great improvements made in recent years with reference to steam as a motive fluid it is unreasonable to suppose that much greater improvement can be made in this particular direction, and hence the necessity for taking advantage of every improvement in mechanical devices to improve the general efficiency of the machine as a transmitter of power from a motor fluid.

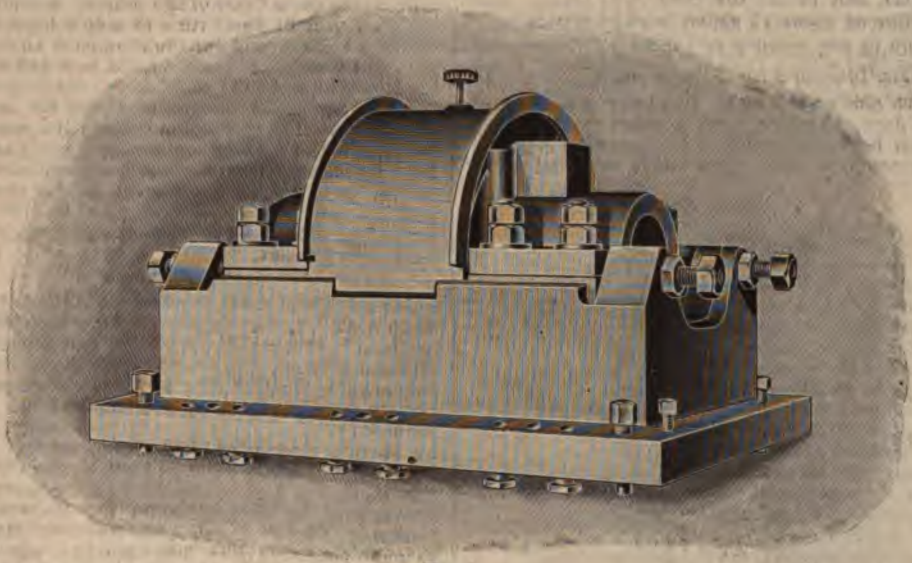


Fig 1.

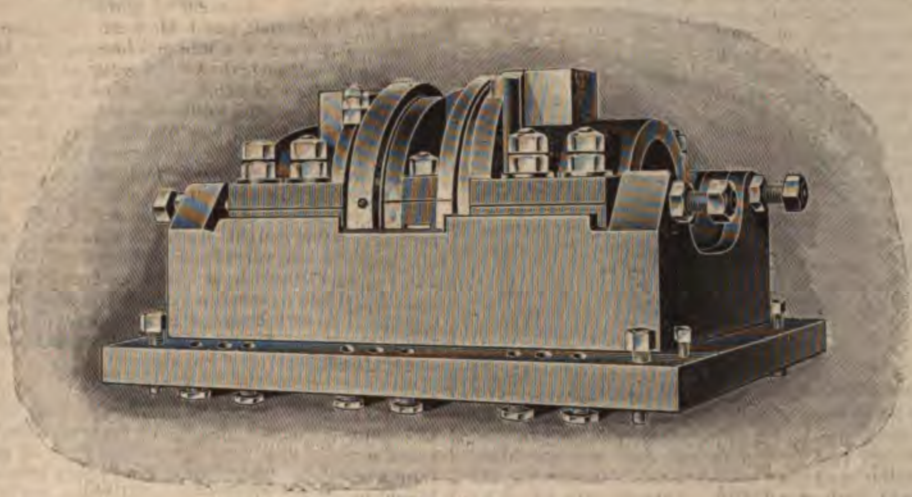


Fig. 2.

Mossberg's Patent Roller Thrust Block.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

The Norddeutscher Lloyd

has increased its already enormous tonnage by a trifle of 19,339 tons in that it has taken over the fleet of the Scottish Oriental Steamship Company, Limited. The fleet in question is contained in some thirteen bottoms. Of these the largest and most modern is the screw steamer *Wong Koi*, built and fitted with triple-expansion engines by the Fairfield Company, of Glasgow, in the year 1896. This vessel has two sisters, the *Chow Tai* and the *Keong Wai*, built about the same time as herself and hailing from the same yard. Indeed, of the whole fleet, 11 are to be put down to Fairfield and the remaining two to Messrs. Caird & Co., of Greenock. The smallest and one of the oldest of the company is the *Bangkok*, built 15 years ago. She has compound engines driving twin screws. Her gross tonnage is but 307. The *Tai Chiow*, one of the largest boats, has recently been in trouble, having been in collision with a German steamship on the bar at Bangkok. The *Tai Chiow* was seriously damaged, the estimate of her repairs being put at about £3,500, and the time for executing them being computed to take 11 weeks. But the blame for the casualty is placed by the court of inquiry to the credit of the other vessel.

In the Atlantic service the Norddeutscher Lloyd Company's *Kaiser Wilhelm der Grosse* undoubtedly maintains her reputation as quite the fastest steamship at work. Exceptional causes may aid towards the accomplishment of an occasional exceptional run and mean speed for single day's runs, and even for whole voyages may be subject to some comment. But average speeds over long series of consecutives voyages are a very searching test, and the *Kaiser Wilhelm der Grosse* passes this triumphantly enough. Taking the average of 11 successive voyages in the year 1899, her average speed to the westward has been 21·84 knots, and to the eastward 22·13 knots. Her mean speed therefore on these 11 round voyages was, as near as may be, 22 knots at sea, summer and winter, clear and fog. She began the year 1900 with a record. Leaving Sandy Hook on the 4th January at 12.35 p.m., she had Cherbourg Breakwater abeam at 9.25 a.m. on the 10th. She had run a course of 3,077 miles in 5 days, 16 hours, with a mean speed of 22·63 knots. This beats her own record for the eastward crossing. Her runs were singularly even. The worst was that of the first day, which, of course, was 35 minutes short of its full time. That 35 minutes may be taken as being equivalent to, say, 12 miles. Her whole run in the broken day was 500 miles. Allowing for the fraction of time when she was not running, the day may be credited with 512 miles. This is only 25 miles worse than the run of the best day of the voyage, which, curiously enough, was the second day out. The sea was reported as "smooth" on the first day, when the run was worst, and "moderate" next day, when she did so well. The direction and force of the wind on these days are not stated, but it would be interesting to know these details.

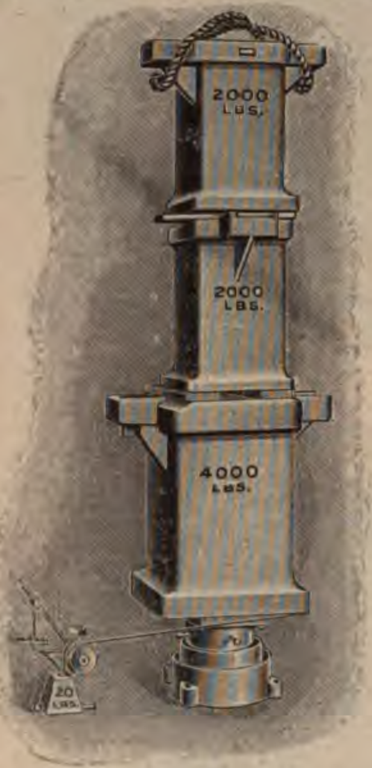

2000 LBS.
2000 LBS.
4000 LBS.
20 LBS.

FIG. 3.
MOSSBERG'S PATENT END THRUST BEARING.

We in this country are deploring the extinction of the sailing ship because of the supposed desirability of training deck officers and seamen to the management of sparred ships, but we are confining our efforts to meet the new situation by making arrangements in some lines of steamships for the carriage of apprentices who shall learn the art of navigation without ever having anything to do with canvas. The Norddeutscher Lloyd, on the other hand, believes that experience in sailing ships is essential if all the qualities of "the handy man" are to be brought out. So it is elaborating a scheme to train its future officers in a sailing vessel on the plan which was some time ago recommended by Lord Brassey and tried in a practical way by Messrs. Devitt & Moore, the well-known London sailing-ship owners. The Norddeutscher Lloyd's ship will give the youngsters a three-years' course at a charge of about £30 a year, inclusive of kit, board, and instruction. Whilst they are being taught their practical work their theoretical and general education will not be neglected, as a schoolmaster with university training will be borne in the vessel. The staff of the ship will comprise an experienced shipmaster, assisted by four officers, and an adequate crew of petty officers and seamen. From sixty to eighty cadets will be taken. Of these about twenty will be in each of the three years of the course. They will be treated for the first year of their time as ship's boys, for the second as ordinary seamen, and for the third as A B.'s. At the close of the third year junior positions will be found for them on board the steamships of the line. Though the ship is to be owned and managed by the Norddeutscher Lloyd for its own service, the Bremen school of navigation will aid the experiment and give facilities to the cadets when they come up to pass their examinations for their certificates of navigation. Marine engineers—who cannot avoid taking an interest in the development of the position which steam has brought to their shipmates, the navigating officers—will watch the progress of this experiment with some interest.

The "Paris."

After five months in dry dock at Milford the *Paris* has been again floated, and arrangements have been completed whereby she is to be thoroughly overhauled and modernised by Messrs. Harland & Wolff, who seem to have the confidence of all large shipowners—whether they be regular customers of the firm or not—in regard to these big overhauling jobs. In support of this remark I need only instance the lengthening of the *Scot*, built by Messrs. Denny, of Dumbarton, for the Union Company; that of the *Augusta Victoria*, built by the Vulcan Company, of Stettin, for the Hamburg-American Company; and that of the *China*, built by themselves for the Peninsular and Oriental Company. The *Paris*, when she leaves the Belfast yard, will do so under the name of an American city, and it is to be hoped that her old ill-luck has been left on the Manacles.

The "Meteoro."

It will be remembered that at the time of the Hispano-American War the Spanish Government bought some three Atlantic mail steamers for the purpose of fitting them out as auxiliary armed cruisers. None of the three ever went to sea, and two of them (one under the flag of La Compagnie Générale Transatlantique, and the other under that of the Hamburg-American Company) have returned to their old labours. The *Havel*, however, formerly owned by the Norddeutscher Lloyd, still remains the property of the Spanish Government, who have renamed her the *Meteoro*. They now wish to dispose of her, and have sought for tenders for her purchase. She is a single-screw steamer of about 7,000 tons, built ten years ago by the Vulcan Company, of Stettin. Her engines are of the five-cylinder triple-expansion type. The tenders, which had to be deposited on or before the 26th January, will be opened on the 3rd February. No offer of less than 2,000,000 pesetas will be entertained.

Liquid Fuel.

Most marine engineers are aware that the Shell Transport Company (of which Messrs. M. Samuel & Co. are the managers) owns a large and very up-to-date fleet of petroleum-carrying tank steamers. They are also probably aware that the later of these vessels are fitted with appliances for burning liquid fuel as an alternative to coal when it may be commercially advisable to do so. The burning of liquid fuel in these ships has now got beyond the stage of experiment, and it has been found that the results of its use are in many ways satisfactory. There is a great reduction in the weight of fuel to be carried—or what is the same thing, with an equal weight of fuel, a great increase of potential energy is stowed in the bunkers. Further than this, stokers are practically dispensed with, and the amount of work that the boilers are capable of is very largely increased. The relation of these facts is not quite news. Yet no shipowners seem to have used the knowledge till the Hamburg-American Company made the plunge. It is now announced that the shipowners in question have entered into a contract whereby supplies of oil fuel are to be provided for their vessels by Messrs. M. Samuel & Co. at Suez, Colombo, Singapore, Hong Kong, and Shanghai. Seven steamers of the Hamburg Company's eastern service are to be fitted for the consumption of this fuel, and the first vessel is to commence the use of it in May. The number of steamers so fitted, for which a supply is to be provided, can be increased to twenty, if the shipowners desire it and give due notice to that effect. The contract is to extend for ten years. If, as the experiments of Messrs. Samuel with the Shell Transport Company's steamer *Strombus* show, the consumption is reduced in the proportion of from 26 tons of Welsh coal to 18 tons of liquid fuel a day, whilst there is a coincident increase of half a knot in the speed of the ship although the number of boilers in action is reduced by one-third, it would seem that the Hamburg Company has done very wisely in making this new departure. But probably before 1900 is out we shall know whether or not the claimed advantages of the system have any serious, and as yet undisclosed, drawbacks to set against them.

Atlantic Passenger Traffic.

I am able to give a table showing the details of the New York passenger traffic in 1899, compared with that of the previous year.

Line.	No. of cabin passengers carried 1899.	Increase over those of 1898.	No. of steerage passengers carried 1899.	Increase over those of 1898.
Cunard	19,045	2,353	20,853	393
Norddeutscher Lloyd (from Bremen)	17,759	1,965	53,646	21,441
Norddeutscher Lloyd (from Mediterranean)	2,235	124	21,645	627
American	14,398	9,361	11,341	5,522
Red Star	4,315	434	20,120	8,232
White Star	12,741	2,469	25,208	4,444
Atlantic Transport	2,657	285	—	—
Hamburg-American (from Hamburg)	14,168	8,656	38,059	20,092
Hamburg-American (from Mediterranean)	426	*4	2,539	*1,614
Compagnie Générale	6,124	921	22,883	7,372
Nederland Line (from Rotterdam)	4,010	857	17,219	4,141
Nederlands Line (from Amsterdam)	135	*97	892	*303
Prince Line (from Mediterranean)	251	10	14,244	657
Fabre Line (from Mediterranean)	35	16	14,104	*1,484
Allan State (from Glasgow)	1,647	303	1,247	119
Anchor Line (from Glasgow)	6,182	1,102	5,512	1,385
Anchor Line (from Mediterranean)	14	*5	13,784	*1,804
Navigazione Generale Italiana (from Mediterranean)	80	80	8,838	8,838
Linha de Vapores (from Oporto)	70	25	1,515	848
Empreza Insulane de Navegaçao (from Lisbon)	140	22	1,369	444
Thingvalla (from Copenhagen)	752	73	3,463	804
Union (from Hamburg)	—	—	4,728	3,273
Various	281	5	551	234

* Figures marked with an asterisk are decreases.

From the figures set out above it will be seen that the Navigazione Generale Italiana has come into the competition during the year. It is also remarkable that there has been a great growth in traffic from French ports, for—although the steamships of the American, Norddeutscher Lloyd, and Hamburg-American lines, as well as some of the vessels of the Nederlands Line, now make calls off French ports and pick up passengers there—there is a distanct increase in the numbers carried by the purely French line, La Compagnie Générale Transatlantique. The decrease in the Hamburg-American Line's Mediterranean traffic is due to the fact that during the year its vessels made only five trips to the westward instead of eight, the number of the previous year. Their actual average number on each voyage showed a distinct improvement. The Anchor Line's Mediterranean service on the other hand, which also shows a decrease, made the same number of trips in each of the two years under comparison. Perhaps the most remarkable increase shown is that of the Atlantic Transport Company, which only carries one class of passengers. As one fewer trip was made in 1899 than in 1898, and as 785 more passengers were carried, we reach the remarkable result that the average numbers carried per trip rose in the year from 42¼ to 61¾ passengers, which is very nearly a 50 per cent. increase.

The Cape Lines, Limited.

Down to the time of writing nothing further has been disclosed with regard to the details and terms of the agreement for amalgamation reached between the Union and the Castle lines. Both offices are, no doubt, fully worked with the business brought to them by the South African War, and this extra matter may well take longer to get through than had been anticipated. But that it is going through admits of no manner of doubt. As the delay has come, however, the detailed history of the two lines may stand over till there is less pressure on the space in this column.

The American Line.

A very interesting and important statement, and one which bears very greatly on the future prospects of the American Mercantile Marine, has been made by Mr. Clement A. Griscom, the president of the International Navigation Company, in his evidence before a committee of the United States Congress. He stated as a fact that the working of his line was carried on at a net annual loss of no less than 415,600 dollars. He further added the significant remark that unless some new—and presumably more beneficial—arrangement was reached, his company would be compelled at the close of the current contract to re-register its vessels under some flag which would *not* be the Stars and Stripes. Now, as is well-known, the company of which Mr. Griscom speaks has many important advantages from the American Government over and above the extremely large subsidy which is paid to it. As an instance of the little aids which it receives may be mentioned the fact that an agreement for an international parcel post has never been reached between our own Post Office and that of the United States. Nor is it likely that whilst the American Line flies the United States flag, such an arrangement will ever be made. As the United States are a highly Protectionist country, the Custom authorities can make a parcel post into New York almost an impossibility. The policy of England being that of Free Trade, there is no difficulty in sending parcels to our ports unless indeed they contain spirits or tobacco. A privilege to a mail line to carry an eastward parcel post across the Atlantic would be almost valueless. That to the west is an important concession. The United States Government, who have the power to control the entry of parcels into New York, have given the privileges of a parcel mail to the private American steamship company, and there is no way in which a corresponding advantage can be given by our Government to our lines which work in competition with it. And yet in spite of all assistance and all fostering—not only by the American Government on the other side of the Atlantic, but even by the London and South-Western Railway on this side—it is practically admitted that the company is qualifying to follow the example of the famous Collins Line, which 45 years ago came to grief in its State-aided attempt "to run the Cunarders off the Atlantic."

THE NEW YO
PUBLIC LIBRA

The "Merrimac."

In last month's Fleets I referred to the steamship *Merrimac* of Messrs. Elder, Dempster & Co.'s fleet as seriously overdue on her voyage from Quebec to Belfast. The unfortunate vessel is now officially posted as missing. She was timber-laden on this last disastrous voyage, and was under the command of Captain Thomas A. Purcell. Her crew comprised about forty-two hands all told, and there would be a dozen or more cattlemen aboard. I give the names of the engineers who are reported as having sailed in her. Mr H. E. Collins, of Pill, chief engineer; Mr. J. Clue, of the Polygon, Clifton, second engineer; Mr. Thomas Beard, of Liverpool, third engineer; Mr. C. Houselander, of Keynsham, fourth engineer; Mr. W. W. Ballantyne, of Cardiff, fifth engineer. The donkeyman, Mr. J. W. Jones, though a native of Liverpool, was last resident at Avonmouth. The fact that Pill, Avonmouth, and Clifton are given as the addresses of so many of the ill-fated crew will be accounted for by the statement that the recent employment of the *Merrimac* had been in the line which Messrs. Elder, Dempster & Co. run between the Avon and the St. Lawrence.

American Mails.

Some time ago it was chronicled that the Saturday mail would leave Euston Station at 4.10 p.m. to catch the Sunday Cunarder at Queenstown, so that the long wait at the Irish port for the coming of the mail train might be curtailed. It was known that the delay at Queenstown was a great annoyance to passengers, as well as a serious expense to the shipowners, whilst, as ships got faster and more expensive to build and work, the delay tended to become more prolonged and to be in every way more aggravated. There was no corresponding advantage to the customers of the Post Office, for few letters are written in City houses on Saturday afternoon, so the change in regard to the Cunard mail was felt to be a beneficial one. After some experience of its advantages the mid-weekly mail has been treated in the same way, and with and after the sailing of the *Oceanic* on the 10th January, 1900, the long wait at Queenstown has been largely curtailed, owing to the earlier starting and acceleration in running of the mail train from Euston on Wednesday afternoon.

The War in South Africa

has largely affected the arrangements of the companies which carry the British New York mails. Both Cunard's and the White Star Line have sent their two reserve ships to work in the transport service. Each line has also sent a mail steamer for the same work. Thus the spare vessels, *Servia* and *Aurania*, of the one service, are busy and unable to take the place of the *Umbria* for Cunard's in the same way as neither the *Britannic* nor the *Cymric* is available to fill the sailing left blank by the engagement of the *Majestic*. Thus, on January 21st, from Queenstown, a westward mail, which should have been taken by the *Umbria*, is omitted. The mails, in so far as they will be ready in time, went forward by the American liner *St. Louis*, from Southampton, on the Saturday morning, and for such as might be too late for her the White Star cargo boat *Cufic* put into Queenstown on Sunday morning. The fact that this vessel and the *Tauric*—as mentioned last month—have been elevated for the moment to the rank of mail steamers, has caused some foolish writing, even in shipping papers. Those who find fault with the Post Office have done so—whether they knew it themselves or not—with the object of getting the British mails sent in American bottoms. For this occasion, what they seek is now being done. The *Cufic* only carries what the American line—through the action of the senders of the letters themselves—cannot wait for. Surely it is better for them to sail on time by a cargo boat, whose speed is not by any means despicable, than to wait till the sailing of the next American liner a week later. This unfortunate moment, when all her fellows are so deeply engaged, has been chosen by the *Etruria* to develop a suspicious-looking flaw in her shafting. This was discovered by her engineers when looking over her machinery at New York. Cunard's, with their proverbial caution, would not risk sending her to sea under the circumstances, and so keep her waiting till a new shaft can be sent out and fitted. Thus, on her account, the Cunard sailing from New York on January 20th had to be passed. The eastward mails of that day are coming to Plymouth by the great Hamburg-American cargo steamer *Pennsylvania*, a fact which should be noted as showing that even the American Post Office thinks freighters a useful substitute for mail steamers when the latter cannot be got.

The Hamburg-American Line

has been indeed unfortunate in the case of the fine twin-screw steamship *Patria*, which, as noted in the Fleets of December, 1899, was sunk off Deal after being on fire for some time in the German Ocean in mid-November. A Danish salvage company soon commenced operations on the sunken vessel, and, after persistent work, succeeded in floating her on the morning tide of January 3rd. But no sooner had they done this than there was a loud bursting sound far down in the vessel, and she sank instantly in deep water. So sudden was the accident that there was no time to cut the painter of a boat which was towing astern with the Danish diver aboard. This poor fellow's helmet had been removed, and he consequently had no chance of saving himself when his little craft was dragged under. Two Deal boatmen, who were stationed on the *Patria's* bridge, also lost their lives. There now seems no chance of making further attempts at salvage, though a Whitstable company is said to be going into the matter, and the wreck will probably be dispersed.

The Transport Service.

As was expected under the circumstances the *Majestic* did not break the Cape record, though she landed her troops in very good time. The fact that she did not do so has raised a fine crop of explanations as to the reasons for the alleged powerlessness of Atlantic steamers to maintain their full speed on the Cape voyage. The simple truth that she was ordered not to exceed a certain speed is not good enough to meet with credence. Those who criticise Western ocean boats adversely on account of this matter may be reminded that the firm which built the *Majestic* also constructed the *Norman* and the *Briton* and are responsible for the reconstruction of the *Scot*. Let me add that they also built for the White Star Company the steamship *Doric*, a vessel which holds a record unknown perhaps to these writers, but as valuable in its way as most; for the *Doric* is the ship which steamed from Liverpool round the Horn to San Francisco without a break, a feat unequalled and unattempted by any other vessel.

As regards the casualties to transports it appears from the report of inquiry that the loss of the *Ismore* was due to the default of her master in not using his lead on the fatal night. His vessel was 13 miles inside of her supposed position, and it is remarked he had the advantage of having a Sir William Thomson's sounding machine aboard his ship had he thought fit to use it.

The *Maltby's* loss on the Black Middens when outward-bound to the Cape with coal for the fleet was laid at the door of her pilot.

The *Denton Grange*, in spite of all care and much hard work, has suffered severely from gales during the month she has lain on the rocks at Las Palmas.

As regards movements and engagements of transports it is difficult to state in the prescribed limits all that is being done. A large number of vessels are carrying troops and horses from Indian ports to South Africa, whilst others are taking mules from the Plate, from Naples, and from the Southern States. Of the engagements of these vessels—highly necessary as is the work they are doing—I cannot do more than say that Messrs. Elder, Dempster & Co.'s, Houston's, and Houlder's lines are doing good work in this direction. In respect of the transfer of the further Canadian contingents to the Cape the Allan Line steamships *Pomeranian*, *Laurentian*, and *Parisian* have been engaged, together with the *Milwaukee* and *Monterey* of the Elder, Dempster Company.

The *Rapidan* has returned to her own station, as have the P. & O. steamers *Oriental* and *Malta*, whilst the Cunarder *Aurania*, the White Star Line *Britannic* and *Nomadic*, the National Line *America*, the Castle Line *Kildonan Castle*, the Allan Line *Bavarian*, the Manchester Liners s.s. *Manchester Port*, the Orient Line *Orient*, the Anchor Line *Persia*, the Glen Line *Glengyle*, and the Brocklebank Line *Pindari* have started on their second trips. Three West India Royal Mail steamers, the *Severn*, *Nile*, and *Minho*, are now engaged. The White Star *Afric* has been secured to take a contingent of the Imperial Yeomanry next month. The Dominion Line *Norseman* has also been chartered. This vessel was till a few weeks ago the Hamburg-American Company's *Brasilia*. Messrs. Elder, Dempster & Co.'s *Lycia* is also chartered, as is their new steamship the *Lake Erie*; so too are the Leyland Line *Winifredian*, the West India and Pacific *American*, and the National Line *Manhattan*. Amongst the more important transports recently starting may be noted the White Star Line *Cymric* on the 1st January, the new P. & O steamship *Assaye* on the 4th, the Cunarder *Umbria* on the 11th, and the Anchor Line *City of Rome* (from her final port Queenstown) on the 18th January.

Many of the Castle and Union liners which took troops on their regular trips are of course on their second voyages. I can only here note the generosity of the managers of these lines, who on their steamships *Briton* and *Garth Castle*, sailing on the 13th of January, took between them 500 men of the City Imperial Volunteers free of cost, and made arrangements whereby the discomforts even to-day attending the voyage of the private soldier under ordinary circumstances would be reduced to a minimum. The little incident of the substitution of china for tinware at the troopers' meals on the *Garth Castle* is one of those little touches of thoughtfulness which make us appreciate how it is that to know Sir Donald Currie is to respect and admire him. Messrs. Wilson, of Hull, are on the same generous terms taking out a further contingent of these troops in their s.s. *Ariosto*.

When the war is over something will have to be said to the contractors who undertook the supply of food for the troops. The meat on the *Arawa*—now returned to the Canadian trade—was condemned. Now there has been trouble over that supplied for the use of the West India and Pacific steamship *American*. Both these cases occurred at Southampton. It is curious indeed how ill luck hangs about the same spots in this matter. The *Ismore*, which stranded at St. Helena Bay, had had two misfortunes previously—one when she had to shelter in Moelfra Bay on account of stress of weather, another when she put into Milford with her horses sick. Now the *Manchester Corporation*, which, with much needed artillery, had to put into Gibraltar to replace two broken blades, has been sighted just south of the Equator, and reports that she has again two blades broken. This steamer, it may be noted, is one of Sir Christopher Furness's new Manchester Liners, Limited.

Messrs. C. W. Kellock & Co.

announce that they will offer for sale by auction on the 15th of February the well-known Union liner *Arab*, built for the Union Company at Clydebank in 1879 by Messrs. J. & G. Thomson & Company. The vessel is of course now too small for the requirements of the company, her gross tonnage not being quite 3,200 tons. She was, however, a very famous and speedy ship in her day, and has in her machinery department been modernised, having had her engines tripled, and having been re-boilered by her builders in the year 1889.

The removal of the *Arab* will leave only four single screw-ships in the Union fleet. The remaining ships are all in active occupation. Two of them, the *Mexican* and the *Moor* (the latter recently modernised and lengthened), are employed to this day in the mail service. The *Spartan* and the *Trojan*, specially fitted out for the Government as hospital ships for the South African campaign, are said to have been at the time they sailed the two best fitted ships that ever flew the Red Cross.

The Isle of Man Steam Packet Company

has ordered a new boat, to be an improved repeat of the *Empress-Queen*, from the Fairfield yard. The vessel in question will probably be ready to do her share of the ensuing summer's service, but it is unfortunate to see that this line has returned to the antiquated paddle. They are possibly too happy in their monopoly. Competition would soon make them appreciate the extravagance of the paddle as compared with the economy and safety of the twin-screw.

The White Star Line

has issued an attractive little souvenir of the *Oceanic*. It is in the form of a little booklet, and rather suggests in its appearance a belated Christmas card. Its front page bears an excellent representation of the biggest ship in the world, lying at the landing stage in the Mersey off the riverside station. Inside are another nine excellent views of the vessel. They show her on the stocks, taking the water, afloat, and in dry dock. They also give several representations of the more remarkable of her interiors. The whole is as tastefully got up as the productions of the firm usually are. One may especially note the harmony between the neutral tint of the cover and the lighter shades of the platino-type print which forms its centre.

DUNCAN'S PATENT AUTOMATIC THROTTLE VALVE.

THE serious consequences which often result from the racing of engines on board ship or the fracture of steam pipes have been the means of directing the minds of engineers from time to time to the problem of how to reduce to a minimum the risk attending such a condition of things. Most of the governing devices operate indirectly upon the controlling valve, and are dependent for their action upon an appreciable acceleration of the moving mechanism, hence a certain considerable interval of time and change of speed must take place at each action of the governor, and much variation of speed often occurs in the movement of the engines.

In the adjoining diagram we illustrate an arrangement which has been designed by Mr. George Duncan, of 106, Victoria Road, Aberdeen, as a simple solution of the problem.

By reference to the illustrations it will be seen that Fig. 1 is a part sectional elevation of the device, Fig. 2 is a plan, Fig. 3 a side elevation of the control arrangement, and Fig. 4 an end elevation of the same.

The device consists of a steam chest a, which is placed in the main steam pipe leading from the boilers to the engine, preferably immediately adjacent to the main stop valve on the boilers. Within the chest a disc a is mounted on a lever $a1$, carried by a shaft $a2$ journalled in the cover of the chest. This disc is adapted to move to and fro in an enlarged portion of the steam chest. On one end of the shaft outside the chest a spiral spring is arranged, one end of the spring being anchored to the steam chest cover and the other end being attached to an adjustable disc carried by the shaft, so that the tension of the spring can be adjusted at will according to the pressure exerted by the steam on the disc a during its passage thereby. On the other end of the shaft $a2$ a lever b is fixed, carrying at its end a tripping detent adapted to engage with a toothed rack to prevent the lever returning, when the device is operated as the result of an explosion.

On the boiler side of the device a throttle valve E is provided, which is operated by an auxiliary cylinder D. The valve controlling the admission of steam to this cylinder is operated by lever $a1$.

In the event of a steam pipe bursting, a casing door in the high-pressure cylinder giving way, or a tail shaft breaking, the increased velocity of steam above that to which the spring B has been set to work acts on the disc a, and moves the slide valve of the cylinder D, which in turn closes the throttle valve E, thereby preventing a further inrush of steam into the engine-room or stokehold.

It will be noticed that the toothed rack c is provided with a bolt $c1$ adapted to be operated from the platform in the engine-room. When the bolt is withdrawn it allows the rack to fall out of sphere of action of the detent, so that, when the spring B is properly adjusted, the device may be used as a governor for the main engines at sea.

Devices having such objects in view as this one are worthy of the attention of shipowners and underwriters, providing means as they do for minimising the risk and safeguarding against the loss of life and property by the bursting of steam pipes and breakdown of machinery.

James Howden & Co.—Mr. James Howden has the pleasure of informing us that, as from 1st January last, he has assumed as a partner his nephew Mr. James Howden Hume, who, for many years, has been associated with him in conducting his business of James Howden & Co., and on whom, during recent years, the greater share of the management has devolved The business will in future be carried on by both of them under the old name.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

A MEETING of the Institute of Marine Engineers took place on January 8th at the institute premises, when an interesting discussion took place on the paper read at a previous meeting by Mr. Halliday on "Experiments showing Decrease in the Rate of Evaporation in consequence of Increase in the Rate of Circulation through the Tubes of Water-tube Boilers." An abstract of the paper was given in last month's "Engineers' Notes." Mr. Halliday opened the discussion by explaining that the figures given were not absolute numbers but comparative. Corrections would necessarily require to be made in order that the numbers should represent the whole evaporation in each experiment. For example, if it is assumed that the water to be supplied for the experiment is at a less temperature than the boiling point, that temperature will require to be made up before the generation of steam begins. And the quantity of heat necessary to be given to the water flowing in the tube must be deducted from the whole quantity given to the tube by the former. Should a greater quantity of water be set flowing, then a greater quantity of heat must be deducted from the total quantity of heat supplied. Virtually, then, it is equivalent to saying that a less quantity of heat is available for causing evaporation when the rate of flow is greater. There si also a loss of heat by the water as it flows from the tube, and this is approximately a constant quantity whatever quantity may be flowing through. The effect, therefore, of the loss of heat due to this will be an approximately constant deduction from the quantity of water evaporated. At the separator there will also be some trouble. Corrections will require to be made in consequence of the loss of heat at the surface. The effect of this will be a fairly constant loss to the quantity of water evaporated as shown by the results. It is desirable that results should be obtained which are very nearly correct, but even without them the results show comparatively what goes on when the velocity of the flow is changed. Mr. Lawrie had objections to the tank with a greater head being used for obtaining the necessary rate of circulation. He thought that the circulation should be produced by heat as it was in the case of water-tube boilers. When Mr. Halliday said, "First of all it may be premised that the accepted view is that the evaporation increases with the rapidity of circulation of water through tubes; that is, the faster the water runs through the tubes, it is believed, the quicker is the evaporation of steam. This is the universal view with one exception." In this paragraph the author made a statement that was not absolutely correct. If he had said that this was the view of experts, he would have been nearer the truth, because most practical men held that circulation was not everything, for in the case of water-tube boilers which had a free discharge from the upper ends of their tubes the results were not better than in the case of boilers with drowned tubes.

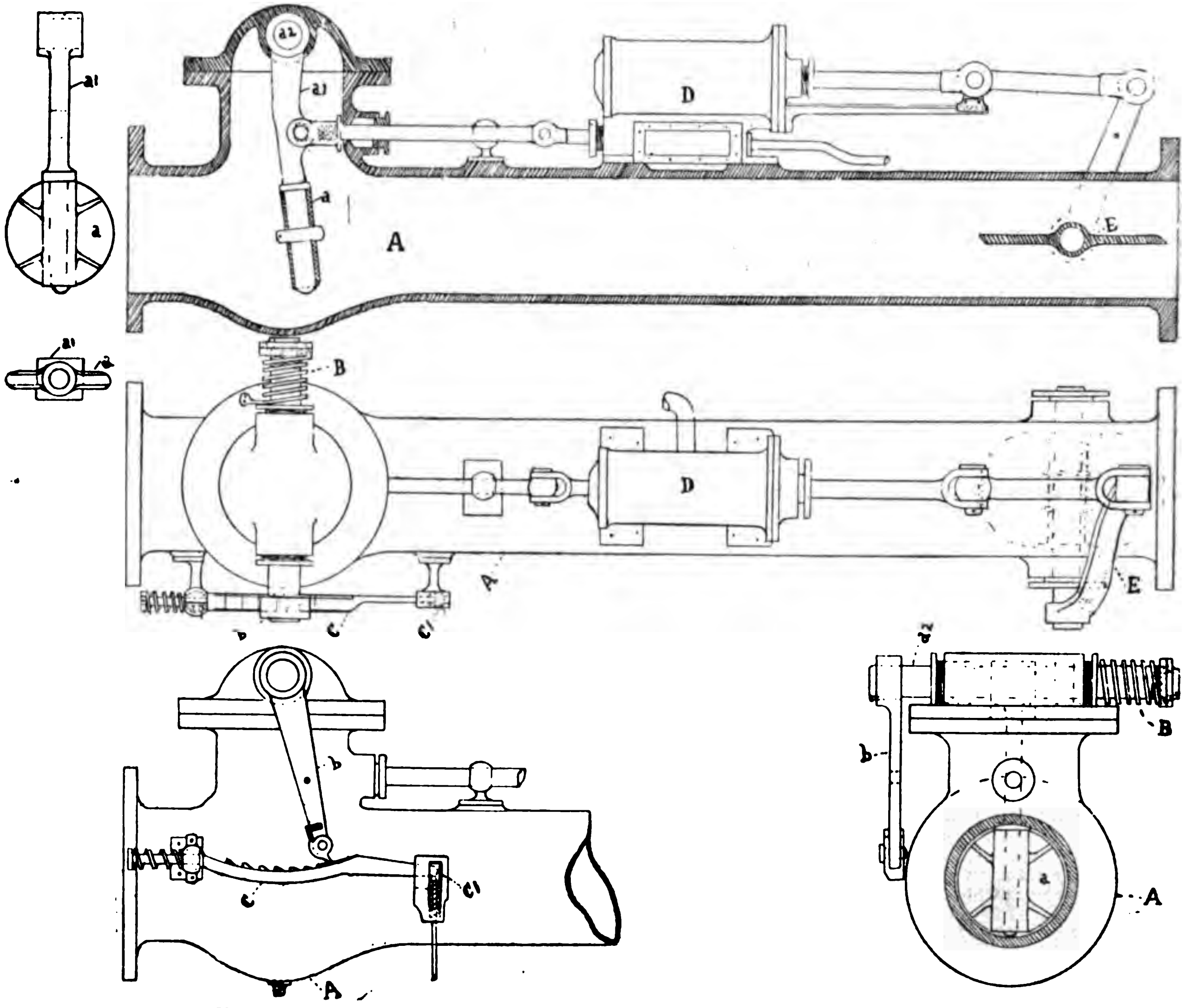


Fig. 1.

Fig. 2.

Fig. 3 DUNCAN'S PATENT AUTOMATIC THROTTLE VALVE. Fig. 4.

He had no reason to doubt the tables included in the paper, because he had himself had a turn with the apparatus, and one or two of his results compared very fairly with those obtained by Mr. Halliday. In answer, Mr. Halliday said that in undertaking those experiments, what he sought to ascertain was how the quantity of steam formed was affected by the quantity of water which flowed through the tubes, the heat employed being constant. As a matter of fact it did not matter in the least in what manner the circulation was produced as long as different rates of flow could be obtained without affecting the quantity of heat applied. If he kept the temperature of the water, going into the tubes, fairly constant, and the amount of heat playing into the tubes fairly constant, and thus varied the speed at which he sent the water through the tubes he could improve the effect of different speeds of flow on the evaporation. As the result of his investigations his advice to makers of water-tube boilers was not to increase the speed of circulation but to decrease it. Mr. Noble showed a sketch of a generator and circulator which he fitted in a ship twelve years ago. In front of the boiler there was fitted a gun-metal cock with a hollow plug. Connected to this there was an internal pipe leading to the bottom of the boiler. A breecher firer was connected to the other end of the cock, into which were jointed two wrought-iron pipes which passed along the furnace crown to a corresponding piece in the combustion chamber, uniting in a single tube leading to a hole in the top of the tube plate. The tube was jointed through the plate to an internal cluck valve. Mr. McLaren expressed the opinion that without a rapid circulation a water-tube boiler would have a very short life. Mr. Halliday said those water-tube boilers in which the circulation was slow lasted about twice as long as those in which the circulation was fast. Mr. Shearer asked in what way the circulation could be retarded, and Mr. Halliday replied it was not his business to show how the circulation should be retarded. Schemes had been designed for promoting or increasing the circulation, and it was conceivable that measures might be devised for retarding the circulation, but the present object was simply to show that a very high rate of circulation did not give the best results.

The conversazione of the institute takes place at the Stratford Town Hall on Wednesday, the 31st of January.

The experimental committee have asked Mr. Aukland to join them in assisting with their work, and Mr. Aukland has kindly consented to do as much as he can for them.

The voting papers for new members of council are now distributed amongst members.

A meeting of the institute took place on Monday, January 22nd, on Mr. Halliday's paper on "The Effects of Circulation on Evaporation in Tubes." The discussion was opened by Mr. Halliday, who said it would be perhaps as well to go through the several points which had been settled by the experiments from the beginning. The first question which was attempted to be determined was one which had been discussed by certain French experimenters. The theory held by these gentlemen, was that molecular change in the water was the cause of the increased absorption of heat at the boiling point. This theory was probably due to engineers finding an advantage by heating the water separately before they sent it into the steam boiler. They heated the water to the boiling point, and then afterwards pumped it into the boiler. That brought an increased efficiency of 19 per cent. in some cases. Now the question which was to be determined by the experiments was whether or not there was an increased efficiency in the transmission of heat just at the boiling point. It was necessary under these conditions to apply as nearly as possible the same quantity of heat each time. When this was done, it was found that more heat was taken in by the water at temperatures below the boiling-point than when it was just at the boiling-point. This completely gave the negative to the theory that molecular change was the cause of the increased efficiency. The second question was whether the increased efficiency was due to increased rate of motion over the heating surface. It was found that when the heat applied was kept constant, and when the velocity of the water over the heating surface was increased, there followed an increase in the rate of absorption of heat by the water. The third question to be determined was whether this increased rate of efficiency continued without limit. It was found that it did not. After a stage in the velocity the absorption co-efficient began to fall off. There was in every case a maximum point. When the amount of heat applied was small, this maximum point came very soon; when it was great, the maximum point came late. The maximum point of some experiments showed four times the velocity of others. When a tube was used, and heat from gas burners was applied to it, a very considerable quantity of heat was absorbed by the water before the maximum point was reached. The fourth set of experiments was to determine what happened when the water which flowed through the tubes was sent through at the boiling point. The results of this last set of experiments were shown in the last paper under discussion. The committee are at the present time determining several questions connected with the feed-water heater. In the experiments which have already been made an insufficient quantity of steam could only be obtained and the limiting effects could not be found. The committee has now obtained a boiler of considerable size for supplying steam, and they will therefore be able to obtain the limit of the effects when steam is supplied in excess. Mr. Lawrie wished to know if the size of the tube through which the water circulated had any influence. It was also stated by Mr. Thornycroft that when his boiler was in full working order 105 lbs. of water circulated through the tubes for every pound evaporated. A higher circulation than that was even given. Could Mr. Halliday give any information as to the best rate of circulation? Mr. Drake explained the construction and working of his patent boiler. Mr. Adamson, Mr. McLaren, and others spoke. Mr. Halliday said Mr. Lawrie's question was answered by the diagrams supplied. It is shown by these that the quantity of steam evaporated when the tube is small, and when 500 cubic centimetres are flowing through it every five minutes, is much greater in a small tube than in a large one, supposing the same quantity of heat supplied on the outside of the tubes. It does not, therefore, follow that a small tube is better than a large one. Experiments were also tried to determine the quantity of heat which might be applied to the outside of different-sized tubes, and the large tube could in every case take more heat than a small one. This appears to point to the fact that a higher circulation could go on in a large tube than could in a small one, and a greater quantity of heat would be absorbed by the water in the large tube, therefore a higher evaporation would go on. It may be pointed out that leading engineers, both in this country and the United States, have a prejudice in favour of large tubes. It would be difficult to say what circulation would be best, the conditions vary so much. But the rates reported as taking place in certain boilers are only rates for the particular cases, and give us no data as to the best rate.

A NEW MARINE SOUNDING MACHINE.

THE recording of the depths of the sea, and especially of off-shore waters, by mechanical means is a branch of inventive research which has long been very attractive to scientists and mechanicians. The importance of sea captains and officers being able to ascertain readily and accurately the depth of the water in which their ships may be moving is recognised to be so great that inventive genius has long devoted itself to the perfecting of sounding apparatus as an obligation to humanity and commerce. Inventors have therefore set for themselves the task of devising and perfecting an ideal sounder, an instrument, that is to say, which shall be suitable for accurately recording moderate sea-depths, and of improving upon the duty of the hand lead-line in shallow waters, and, withal, of giving a continuous record if required. Twelve months ago it was announced that a Liverpool engineer, Mr. Edwin S. Cornish, had produced a sounding machine which came nearer to fulfilling these *desiderata* than any sounder at that time in use. The new machine gave good results in practice, but there was a detail which the inventor found could be modified with advantage. The modification has been made, and the improved instrument or "automatic-lead," as it is termed, is now being manufactured by Messrs. Capstick & Carefull, engineers, of Liverpool, for Cornish's Marine Automatic-Lead Syndicate, Limited, the proprietors of the machine.

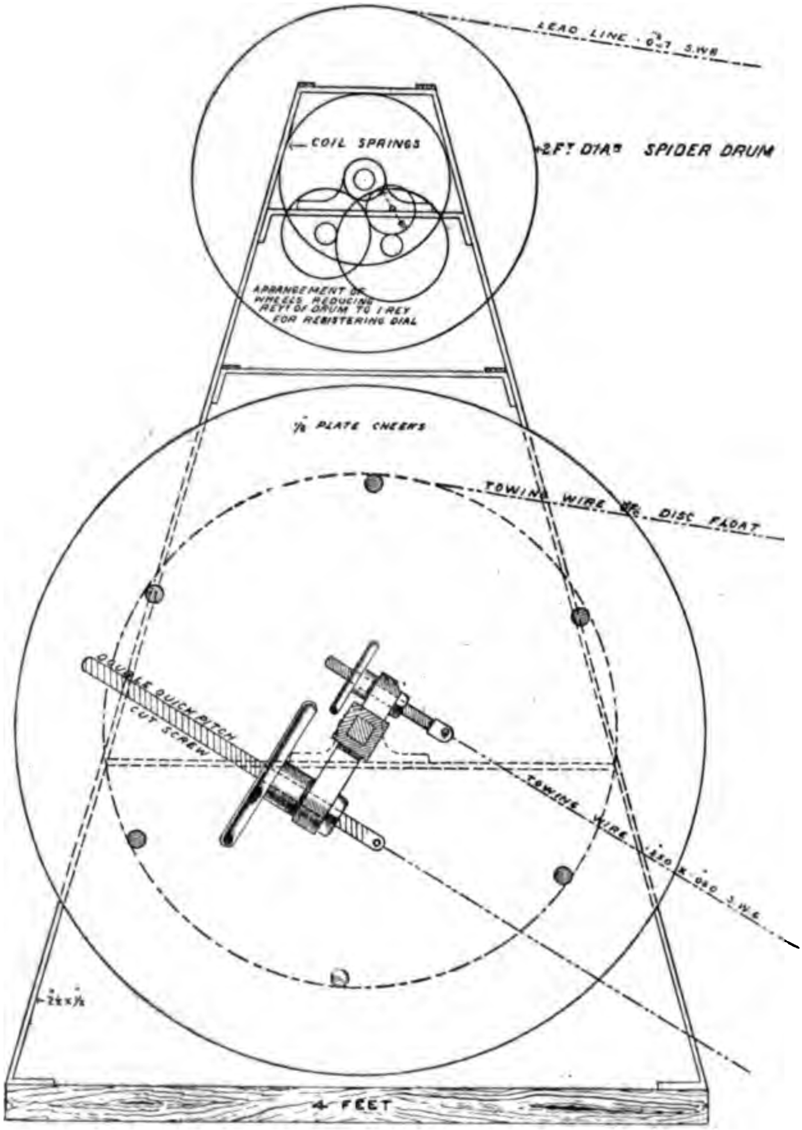

LEAD LINE ·0·7 S.W.G.
COIL SPRINGS
2 FT DIAM SPIDER DRUM
ARRANGEMENT OF WHEELS REDUCING REV. OF DRUM TO 1 REV FOR REGISTERING DIAL
½" PLATE CHEEKS
TOWING WIRE & DISC FLOAT
DOUBLE QUICK PITCH CUT SCREW
TOWING WIRE ·150 × ·080 S.W.G.
2½ × ½
4 FEET

Fig. 1.

The inventor has for the last eight years filled the responsible position of superintendent of the dredging operations at the bar of the river Mersey, under the Mersey Docks and Harbour Board, of Liverpool. During these eight years a passage has been dredged through the bar, so that, for some time past, the largest ocean-going steamers and sailing ships have been able to enter and leave the Mersey at any state of the tide, which could not be done before the dredging operations referred to began. During the operations sounding has gone on almost without interruption, the effect of the dredging being closely watched. In designing his automatic-lead, Mr. Cornish had the advantage of a large experience of marine sounding, and of the effects of strong currents and different depths in relation to currents upon sounding apparatus. He aimed at producing a sounder which should be easy to use and give a correct and continuous automatic record—on deck, on the bridge, or in a captain's cabin. The apparatus may be described as consisting of two main parts: a winding and recording machine, which is placed at a desired spot on the ship, and a set of three "towing wires" and a "lead-wire," which are submerged for ascertaining the depth of the water. The purpose of the three towing wires is to furnish means of working an efficient "sinker," which is towed or "trailed" along the bottom as the vessel using the automatic-lead moves forward. When the length of ship admits thereof the drum carrying the towing wires will usually be placed well forward on the ship, and the lead-wire, which is the recording-wire, will be worked through an outrigger placed aft. When in use the towing wires are paid out, and the disc, or lead, trails along the bottom and the depth will be ascertained by means of the lead-wire which is fastened to the lead or sinker. The lead-wire will pass in-board on the ship and the wire will be prevented from drifting by being secured to the sinker which is trailed after the ship. As the sinker rises or falls in following the form of the bottom of the sea, the lead-wire is automatically paid out or hauled in, so as to be maintained in a state of approximate tautness. Each lengthening or shortening is shown by the recorder of the machine on deck, so that a continuous record of the variation in the depth of the water may be obtained.

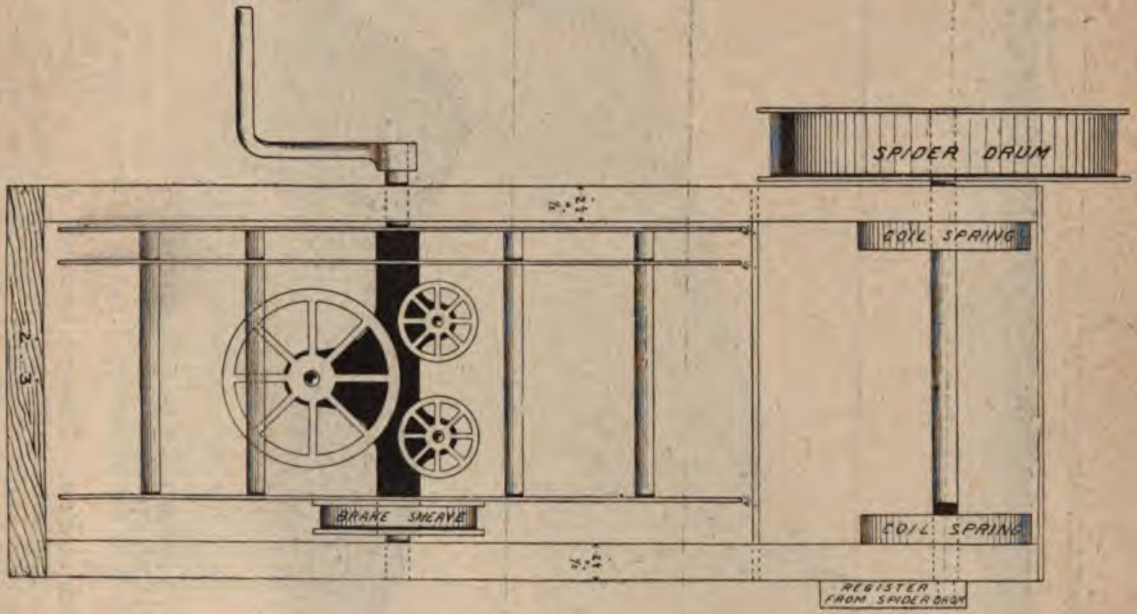
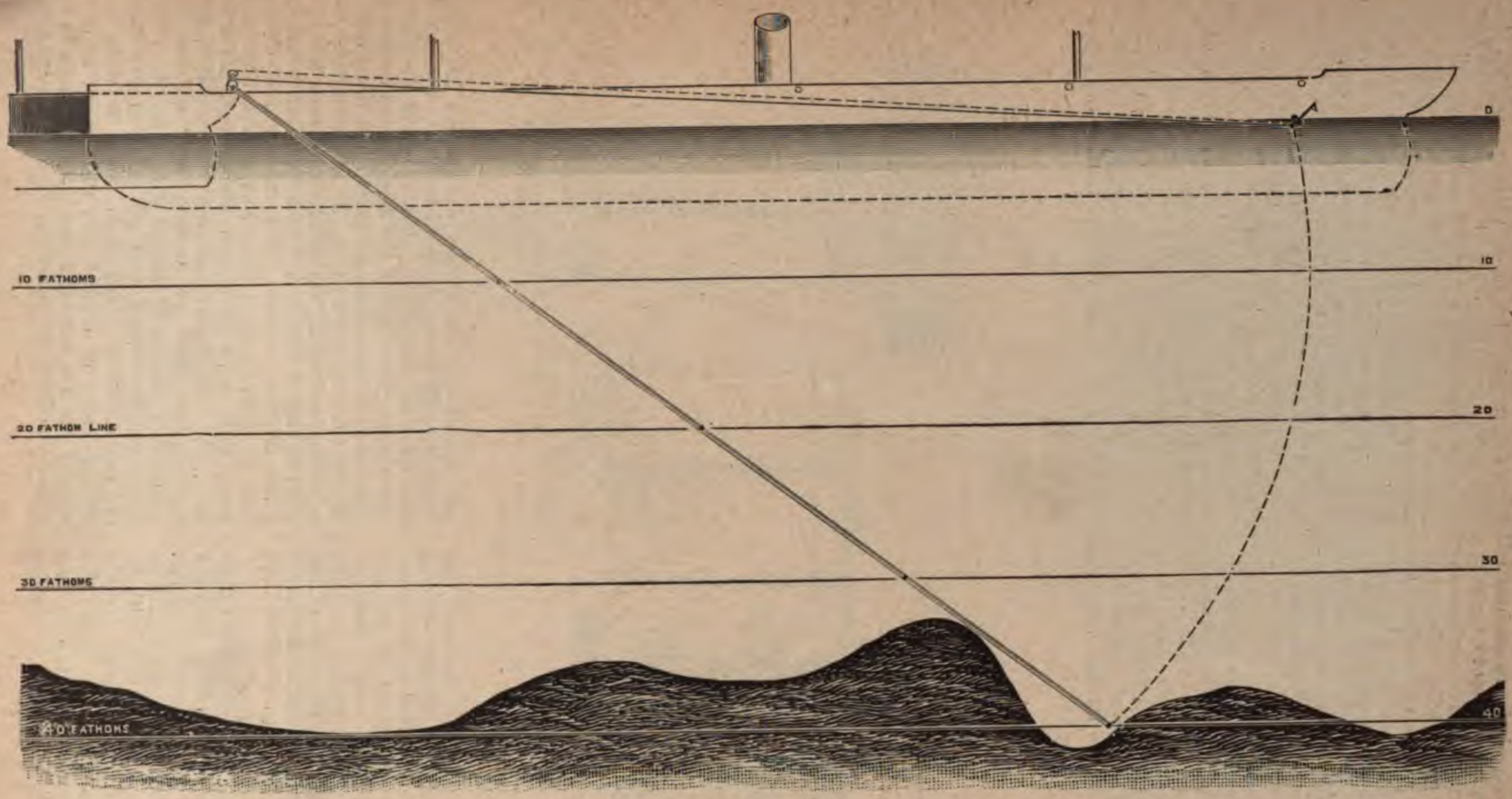


Fig. 2.

When used on ships of short length the practice is somewhat different. In this case, the drum carrying the trailing or towing wires is placed at the stern of the ship, and a float carrying a sheave is towed astern at the end of a rope the same length as the wires paid out to tow the lead or sinker. The lead-wire passes from the sinker upwards to the sheave on the float, and through the sheave to the drum of the recording machine on the ship. Whether in shallow or deep water, the action of the automatic lead is the same. The lead is trailed along the bottom of the sea, and as it follows the irregularities of the bottom, the lead-wire automatically pays out or is hauled in. The automatic lead can be worked over the stern of any ship for shallow or deep soundings, and at the side of ships which are of sufficient length to admit of such use.

The details of the automatic lead apparatus will be made clear by reference to the diagrams. Figure 1 shows the side elevation of the improved machine. This comprises a drum for the towing wires, and an upper and smaller drum for the lead-line, with an arrangement of wheels for reducing the revolutions of this drum to the necessary movements on the face of a registering dial. The machine is contained in a light steel frame, which has a base 2 ft. 6 in. wide, is 6 ft. 6 in. high, and narrows to about 10 in. at the top. The sides of the frame are 2 ft. 6 in. apart. The lower drum is fitted with a double quick-pitch adjusting screw, and two other adjusting screws for regulating the length of two of the towing wires and the angle of certain discs which are used with the wires. There is a handle for winding in the wires, and a brake for controlling the run when paying out.

The upper drum which is used for the lead-line only, is a spider drum, which, as will be seen from Figure 2, showing the back elevation of the machine, is hung outside the frame. This drum is 2 ft. in diameter. The registering mechanism is placed outside the frame at the other end of the drum spindle. Inside of the frame at each side, also on this spindle, there is a coil-spring which performs an important duty. In the machine as at first made, a counterpoise weight was used in conjunction with the lead-line drum, to cause the drum to revolve and wind in the slack of the lead-line as the sinker rose through the water becoming shallower, so as to maintain a constant and automatic movement. The weight of the sinker was greater than that of the counterpoise weight at the drum, so that as the sinker fell to a lower depth it drew the lead-line with it. At the same time the counterpoise weight was sufficient to keep the line taut, so that a steady and reliable record could be given on the register. The counterpoise weight was found to be inconvenient, so it was dispensed with, and in its place two coil-springs are now used. As the drum pays out the lead-line, the springs are coiled or "wound up," and acquire a sufficient reserve of energy to cause the drum to revolve the reverse way and wind in any slack of the lead-line which there may be with the varying depth of water. The substitution of coil-springs for the original counterpoise weight was an unquestionable improvement as regards convenience.



A NEW MARINE SOUNDING MACHINE. FIG. 3.

The two drums, it should be noted, are entirely independent of each other as regards position and movement. They are ordinarily placed in the one frame as a matter of convenience. The lead-line of the upper drum is of No. 20, S.W.G. ·037 in. wire.

As stated, the towing arrangement consists of three wires. These are flat, and of ·250 in. by ·060 in. S.W.G., and in conjunction with them a set of "plate discs" is used. The ends of the three towing wires are attached to a disc 15 in. in diameter, which is known as the "lead-disc" or the "lead." It is this disc which has been referred to above as the "sinker" and the "lead," and is the part of the apparatus which is dragged over the bottom of the sea by the progress of the ship during the taking of soundings. The lead-line is attached to this lead-disc, and the disc, by means of the line, imparts motion to the registering hand of the dial on board the ship. The automatic lead can be made as a 20, 30 or 40-fathom sounder, as it is constructed in 100 feet lengths, which give 10-fathom soundings, 4 lengths giving 40 fathoms.

At distances of 100 ft., measuring from the lead-disc, three other discs, each 12 in. in diameter, are placed. Two of the towing wires are connected with the upper edge of the discs, and the third wire with the lower edge. The purpose of the discs is to prevent parabolic curvature of the towing line or lines when in use. By means of the adjusting screws on the lower drum of the machine, either of the upper wires may be eased or tightened to admit of steering the lead in narrow waterways, or, the lower wire may be adjusted so as to cause the discs to ascend or sink in the water, as desired, by the alteration of the angle which they present to the water.

Figure 3 shows the respective lines being used from the stern of the ship, the lead-line in this case passing through the small block at the underside of the float which is being towed astern. After use, the towing wires are wound in on the drum, and the discs stowed on the drum or hung on hooks along the rail. The lead-line will be wound on its own drum, and the machine be compact until wanted for further use.

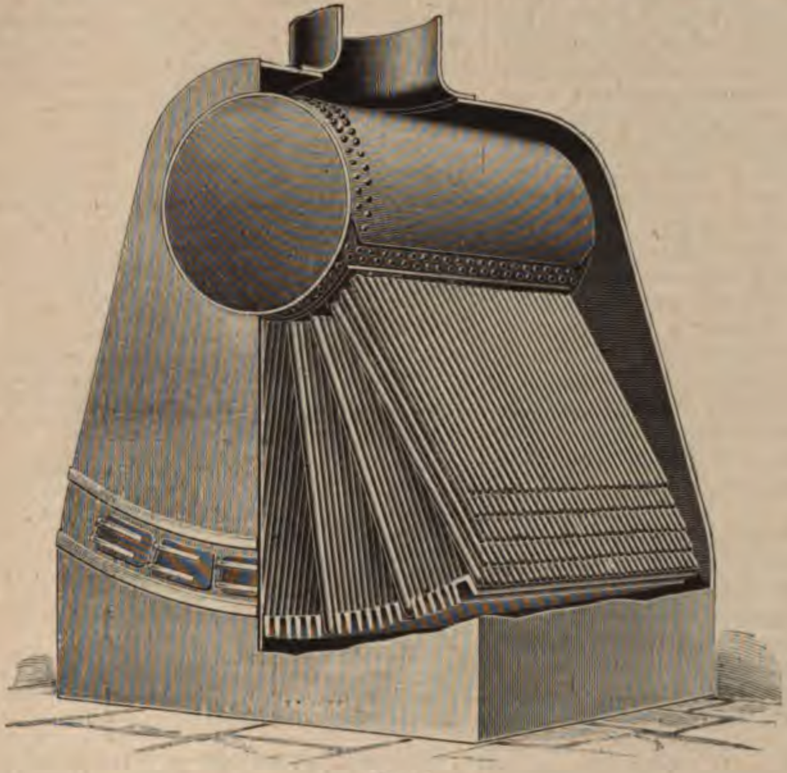


FIG. 1.

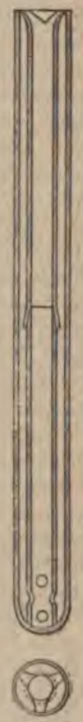


FIG. 2.

This marine automatic-lead has been patented in England, America, Germany, and other countries, and by the operations of the syndicate who now control it will doubtless soon be in large use.

Marine Engineers' Examination.—At the examination held on January 9th, 10th, and 11th the following candidates passed for extra first-class engineers: Mr. N. Nasservanjee, of Bombay; Mr. Banks, of Bishop Anckland; Mr. Kluge, of Swansea, and Mr. H. A. Williams, of Dartmouth. They were prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields, making 67 pupils who have passed in the above grade from this establishment. Mr. N. Nasservanjee came from Bombay expressly to become a pupil at this school, and passed the first time of going up.

PHILLIPS'S WATER-TUBE BOILER.

THE attention that has of late years been devoted to the water-tube boiler for marine purposes has given a considerable impetus to inventors to find means to remedy the various defects and disadvantages that have been brought to light from time to time in relation to water-tube boilers under the conditions of working that at present obtain.

In the adjoining diagrams we illustrate a new design of water-tube boiler which has been invented by Mr. Horatio Phillips, of Roedean, Brighton, and for general simplicity of design, construction, and arrangement it will be readily conceded that it ranks high amongst similar devices which have had a practical trial up to date. The boiler consists essentially of a drum as the main water-and-steam chamber, from the under side of which a number of tubes project radially in a downward direction. These tubes are of the Field type, and each carries a down circulating pipe. Fig. 1 is a perspective view of the complete boiler with a part of the casing removed to show the tubes. Fig. 2 is a detail view of one of the water-tubes to an enlarged scale. It will be noted that the tubes are arranged in double rows, and their ends pass between the bars of the grate. In this way they divide the grate into five separate divisions. It is claimed by Mr. Phillips that by these means he obtains many important advantages. Firstly, nearly the whole of the tubes are exposed to the radiant heat of the fuel, and for this reason a high evaporative efficiency is obtainable from this heating surface. Secondly, the many difficulties of stoking a water-tube boiler are overcome, as it is made much easier, and can be done by men of little or no skill. The large grate surface of the ordinary water-tube boiler has the serious drawback that it is very difficult to maintain a uniformly thin fire over it. The usual thing with untrained men is that the fuel is heaped in some parts, whilst in other parts the grate is uncovered, and, to maintain a fairly even result, they run with much thicker fires than is necessary or desirable; very imperfect combustion ensues, and the worst conditions obtain for a result of high efficiency.

The width of the grate between the double rows of tubes is 15 in., and it is found that these strips of grate can be easily stoked to produce a uniform result over the whole grate surface. A further advantage is claimed that, as the gases evolved from the fuel on each grate have to pass the tubes into the next space on their way to the chimney, should they be unburnt in their passage past the first tubes, they will be burnt in the next space over the second fire. Of course, this does not apply to the wing grates; but, on the whole, unburnt gases have a much greater chance of being burnt than obtains when they can pass unobstructed to the chimney, losing their temperature rapidly on the way.

In the use of Field tubes in the ordinary way their ends are situated in the hottest zone of the furnace, and when the fire is forced they are very liable to be burnt. This objectionable feature is overcome by carrying the ends of the tubes below the bars.

An important feature of construction is the facility with which an internal and external inspection of the tubes can be made, and a faulty tube can be readily replaced without disturbing the remainder. The circulating tubes are in two halves, to permit of withdrawal upwards, and each water-tube can be emptied by inserting a hose to the bottom and sucking out the water, so that the interior can be inspected by the aid of an electric incandescent lamp.

As the tubes are each supported independent of one another, they are free to expand and contract, and are not liable to be bent by variation of temperature.

In comparing this boiler with others of its class it is claimed that the cost of construction is 25 per cent. less, the saving of weight is 20 per cent., and the space occupied is less than any other boiler of the same power. There are no heavy bottom chambers with their contained dead water, and very little fire-brick is used in the furnace casing. A further important point appears to us to be the fact that, as the fire-doors are five in number, their size is small, and, consequently, the amount of cold air let in over the fire in the act of stoking is much reduced compared with the usual conditions that obtain.

Many trials have proved that with a width of 15 in., a length of fire-bar of 6 ft. 6 in. can easily be stoked.

A miniature boiler of 200 H.P., with which a great many trials have been carried out, has five furnaces, each furnace being only 8 in. wide and 4 ft. long, and by using special firing tools can be stoked with the greatest ease. A labourer, who was totally ignorant of stoking, succeeded in the presence of an Admiralty official in evaporating 3717·5 lbs. of water in one hour with 480·5 lbs. of coal. The steam pressure 250 lbs. per square inch. Temperature of feed 60°.

ELECTRICAL NOTES.

(From our own Correspondent.)

MR. R. E. CROMPTON read a valuable paper on the "Influence of Cheap Fuel on the Cost of Electrical Energy" before the Institution of Electrical Engineers. He had put himself in communication with several colliery proprietors, and he had ascertained that in the Midland district, Nottinghamshire, Derbyshire, and Yorkshire there are supplies of slack coal available, the average price of which during the last ten years has been about 2s. 6d. per ton at the pits, and it could be delivered by railway carriage within a radius of 50 miles for about 5s. 4d. per ton. The freight is the same whatever the quality of the coal may be. It would pay to use this kind of coal at greater distances than 50 miles. At Chelmsford it would cost 14s. There are three distinct classes of cheap fuel. First, the anthracite and small Welsh coals; second, free burning small coals of the Midlands; and, third, small dirty or earthy bituminous coals of the north. The first is dealt with by having large water ashpans, the steam rising from which appears to have the effect of preventing the clinker from clinging to the bars. In the second class automatic stokers have been much applied. For the third class coking stokers have been used These spread the coal on the front end of the grate. This method has not worked out well in practice. The simplest and most efficient method is by using the old Jucke's revolving grate, which has been in use for upwards of 30 years. At Fowler's works, at Leeds, it has been in use for 28 years. Most improvements in smoke consumption have been made by introducing more air, but the excess of air lowers the efficiency by supplying too much of a body to absorb heat. It is better to have a special combustion chamber. He would place a bridge immediately above that part of the grate in which the fuel is ignited. This bridge should be an extended firebrick arch, each arch-shaped brick having a fin-like projection hanging down from its lower surface into the path of the gases. The extended surface of firebrick acts as a reservoir of heat when the fire-door is frequently opened, but it acts better when the fire is automatically served. That it is important that excess of air should be kept down is shown by the following table:—

	Test of water-tube boiler at St. Pancras.		Test of water-tube boiler at Glasgow.		Result (with excess of air kept down) at Glasgow.	
	B.T.U.	P. ct.	B.T.U.	P. ct.	B.T.U.	P. ct.
Heat transferred to water	10,463	72·6	8,228	68	9,960	83
Heat carried off with products of combustion and excess air	1,792	12·4	2,959	25·25	1,440	12
B.T.U. in fuel ..	14,400		12,012		12,001	

Electrical Power for Marine Propulsion.—Mr. C. T. Child has been investigating the conditions under which electrical appliances are used in marine propulsion. The disadvantage of accumulators lies in their great weight, and he finds that under the very best conditions the weight of an electrical equipment is about 234 lbs. per H.P. as compared with 57·5 lbs. in the case of steam outfit. His plan would be in the case of ferry boats to charge them from a shore station at the end of each trip. This he thinks would show a much higher efficiency than other means of propulsion. He also thinks that torpedo boats could be driven by electric accumulators and keep up a speed of 22 knots for one hour, or 12 knots an hour for twenty-four hours, with the same battery.

Electric Traction on the Erie Canal.—Barges and other craft are pulled along the side of the canal by horses, for there is a tow-path; but a company has been formed to improve the means of haulage. This company, the Erie Electric Traction Co., has adopted the storage battery system for its motive power. The *Electric Review* says:—"An electric traction engine will run along the towpath of the canal. It will tow a canal boat fitted with storage batteries of sufficient capacity to furnish current for the traction engine, and for a reasonable number of canal boats with cargoes towed behind the battery boat."

Marconi's Visit to the United States.—Simple great men like Faraday and Bunsen did not trouble themselves greatly about the pecuniary value of their work. They were content to allow it to remain invaluable. Mr. Edison and M. Marconi, who deal more with the application to the industries of the principles of science, have other ideas. The United States Navy Department has ordered off four officers to inspect and report on the system of wireless telegraphy by M. Marconi as to its advantages for signalling purposes aboard ships and between vessels and the shore, M. Marconi has put down the price of his part at 1,000,000 dollars for its unlimited use or 500 dollars a set and 500 dollars royalty a set. An American paper says that the Government think the price high and are considering the availability of another inventor's system.

A New Possible Electric Lamp.—A light of an expensive kind has been promised by a prominent London electrician. It is said to be possible to get several hundred candle-power with a pressure of 8,000 volts, at an expenditure of one watt per candle power. The light was obtained from cathode rays, which are the bombardment of the highly attenuated particles of matter in a highly attenuated form. These rays were concentrated at one point, setting up there an extremely high temperature comparable with that of the electric arc. When a disc of thoria, one of the emissive substances used in Welsbach mantles was employed, the high temperature obtained gave a highly efficient light.

Mr. A. Siemens says there is a great advantage in electric power on board ship in the absence of clumsy and leaky pipes. The difficulty is the variation in the loads in auxiliary machinery. The strain on a winch often stops it. In such cases shunt-wound motors driving through friction clutches are used, or else series-wound motors, with a special cut-out arranged to break the main circuit on occasion and only allow a certain current to flow through a by-pass circuit. Mr. Siemens had seen an electric steering gear and rudder indicator worked with shunt-wound motors at the electric pumping station at the United States Navy Yard. There is to be an underground electric pumping station for dry dock No. 1, costing about 40,000 dollars. This station is to be underground in order to save space in the Navy Yard. It is to be located at the head of stone dry dock No. 1, and will replace the old station, which was built in 1854. Centrifugal pumps worked by electricity, and having a capacity for throwing 80,000 gallons of water out of the dry dock a minute, will be placed, and 350 E.H.P. electric motors will be used to operate the pumps. When the new plant is completed, the dock can be emptied in one-third of the time now required and at one-half the cost. It will take five months to build the new pumping station.

Electric Power in Engineering Shops.—A paper was read by Mr. G. H. Bowden before the Glasgow University Engineering Society on this subject. He pointed out that there was great waste by driving isolated tools and groups of machines by small steam engines and long lengths of shafting. Sometimes there was as much as a consumption of 20 lbs. to 30 lbs. of coal per H.P. burnt, while a well designed electric power plant reduced this to 3 lb. or 4 lbs. The engineering works on the North-East Coast had a capital expenditure of £8,000, and the annual saving exceeded £3,000 per annum. At Messrs. Furness, Withy & Co.'s the electric plant was double the power of the old steam system, yet the power costs were less than before. Works, equipped with shafting well lined up and efficiently loaded, such as some types of machine shops and textile factories, did not present the same inducement for their owners to apply electric power. A good arrangement in a works of 300 H P. would be to put down two units, one of 200 H.P. and a second of 100 H.P. During the day the 200 H.P. set would meet the demand; as the lighting load came on, the 100 H.P. set could be put on and run in parallel. For a night shift the-100 H.P. set would do. At Middlesbrough one large plant had three sets of 750 H.P. each. The generator seldom need exceed 60 to 65 per cent. of the motor H.P. installed. At Messrs. Furness, Withy & Co.'s works the generating plant was 450 H.P., whilst the motors installed aggregated 800 H.P. For outputs up to 200 H.P. high-speed engines are preferable. From that to 400 and 500 H.P. medium-speed engines were better. Messrs. Workman, Clark & Co, Belfast, had slow-speed horizontal engines driving a multipolar dynamo of the fly-wheel type. Furness, Withy & Co. had marine-type engines driving the dynamos by link belts. Messrs. Scott & Co., Greenock, had their three shipbuilding yards recently equipped with electric power. In this generating station there were three units, having an output of 200 E.H.P. each, coupled to high-speed engines. The hydraulic and compressed-air plant were in the same engine-room. He thought the works ought to be split into sections and supplied from panels in the switchboard. It was always best to use bare wires for feeders where possible, carrying them on insulators along the shop walls. The insulators were of tin of the petticoat type. Punches, shears, &c., could often be fitted with an enclosed motor. In driving a number of small machines judicious grouping to a small centre shaft was best. In this connection it was desirable to place the motor so that it would drive on to the middle of the shaft, and not the end. All motors should be of one or two standard sizes. For instance, 10 H.P., 15 H.P., and 20 H.P. motors might be used instead of several odd sizes. In one case only 20 H.P. motors were used. Shunt motors gave good results. Polyphase machines should not be used. Their advantage was that there was no commutator; but against this there were many disadvantages. Their power factor was so low when starting that he had seen a 100 H.P. generator overloaded when starting a 20 H.P. motor.

Wireless Telegraphy in the Navy.—The Admiralty have determined to fit several vessels of the Channel Squadron, the *Majestic*, *Magnificent*, *Hannibal*, and *Jupiter*, with wireless telegraphic instruments on the Marconi system; and the signal boatswains of the two flagships, and two petty signal officers on each of the ships in question are now being instructed in wireless telegraphy on board the *Hector* at Portsmouth.

Glow-Lamp Explosions.—Mr. G. C. T. Bartley, M.P., has written to the *Times* a warning to users of glow-lamps. It is said that in turning on an electric lamp it exploded with a report like a pistol, the socket of the lamp was blown out, and the glass, in "myriads" of atoms, was sent in all directions, although a tilted shade saved his face. The lamps had been supplied by the Westminster Co. shortly before Christmas, when the pressure was doubled. The *Electrical Review* explains the matter by stating that it was the lamp-socket which exploded, and that it was due to a short circuit in the holder, which at 200 volts would act with explosive violence. Such a short circuit sometimes occurs when the cap is being inserted into a live holder, and several lamps have exploded in the act of insertion into a holder without first switching off. The danger lies in carelessness in putting the lamp in place and neglecting to switch off before doing so.

THE S.S. "KOREA."

AFTER the opening of the Copenhagen free port in 1895 the shipowners and managers of that city considered that, owing to the go-ahead and prosperous state of the trade in this and other ports, new lines and larger ships could be profitably run. This theory was at once put into action, and we now see (five years afterwards) new and regular lines running to America and the East, the latter line being under the control of the East Asiatic Co., of Copenhagen, by whom orders were placed for three new vessels—one, the s.s. *Malaya*, with Messrs. William Hamilton & Co., of Port-Glasgow; another, the s.s. *Cathay*, with Messrs. Ramage & Ferguson, of Leith; and a third, the s s. *Siam*, with the Flensburg Shipbuilding Co.—all of about 6,000 tons deadweight. Unfortunately, owing to the engineers' strike, the Scotch builders were unable to deliver their vessels within the stipulated time. The honour of opening the new route, therefore, devolved itself upon the Flensburg-built steamer *Siam*. However, some little time after, the company found it necessary to enlarge their fleet. Orders were, therefore, placed for three more vessels two in Copenhagen and one in Flensburg. At the same time the company, having made a contract with the Russian Government, by whom it is subsidised, opened a branch in Russia, and their route now extends to Vladivostock. Our first illustration shows the passenger and cargo steamer *Korea* (*see* November issue, page 373)—her principal dimensions are: 428 ft. by 49 ft. 8 in. by 30 ft. 6 in. moulded, having a deadweight-carrying capacity of about 7,000 tons—the latest addition to the East Asiatic Co.'s fleet, leaving the Flensburg harbour under the Russian flag; the second, the quaint and interesting ceremony of the vessel being blessed by a Russian priest, according to Russian rites.

THE S.S. "KOREA" BUILT BY THE FLENSBURG SHIPBUILDING CO.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our own Correspondents at home and abroad.*)

The Mishap to the Royal Yacht.

CONSIDERABLE alarm was occasioned early last month by an accident which happened to the new royal yacht *Victoria and Albert*, whilst she was being undocked at Pembroke. It seems that she heeled over to port about 25 degrees in the dock as soon as sufficient water had been admitted to float her, and when this was realised by the dockyard officials, the caisson at the dock entrance was replaced, and every effort made to keep her afloat until measures could be adopted to right her. The caisson, however, jammed before it was completely closed, and, despite the fact that water was kept continuously pouring into the dock from every available source of supply, the depth of water inside steadily decreased, leaving the yacht in a most precarious position. A considerable strain to the ship and her machinery must have been caused by the accident, but there is no reason to believe the stories put about that the vessel can never entirely recover her original shape.

The vessel was partly righted by the stowing of 140 tons of iron ballast on board. The worst damage sustained by the vessel is where a 6-in. frame is said to have been completely sheared through. The engines are said to be entirely without damage, but the propellers were uncoupled at the time of the accident, and it is possible that the shaft of the starboard propeller has been strained. The yacht is now lying at Portsmouth. New plates are to be supplied in place of those dented at Pembroke.

The Guns of the "Handy Man."

Almost every day accounts are published of the excellent work carried out by the naval brigade and their guns both on the eastern and western borders of the Boer Republics. Both 4·7-in. and 12-pounder naval guns have been sent round to the eastern border to reinforce the artillery operating with Lord Methuen, some of them mounted on the 40-pounder muzzle-loading gun-carriage. In all the battles in which Lord Methuen's forces have been engaged the guns of the naval brigade with him have played an important part, the terrific power of the lyddite shells carrying death and destruction into the Boer trenches. On the western border, with General Buller, the naval gunners have also been busy. At Colenso, two 4·7-in. and 14 long range 12-pounders, all belonging to the *Terrible*, and on Captain Scott's mountings, were engaged. As many as 28 oxen were required to draw the big guns, and the naval contingent altogether consisted of 254 men, under Captain Jones, of the *Forte*. The naval guns began the bombardment of the Boer position two days before the battle of Colenso at a range of 7,200 yards. The two larger guns, we are told, were fitted with telescopic sights designed by Captain Scott. According to the account sent home, the part played by the navy during the battle of Colenso was a most important one. The native drivers of the oxen, dragging the 12-pounders, ran away when the enemy opened fire, but the sailors took their places, and with great difficulty brought their guns into action. For nearly three hours, too, the naval battery was in action entirely unsupported, and, although there were only four naval men wounded, there were several extraordinary escapes. Lieutenant Ogilvy, for instance, had three shells from a Hotchkiss pass between his legs. The 4·7-in. guns also did good work, and, as an example of the excellent practice made, the destruction of the road bridge across the Tugela may be mentioned. At a range of 7,200 yards, chief petty officer Bates, of the *Terrible*, wrecked the centre span at the tenth round. Some of the naval guns are accompanying General Buller in his advance towards Ladysmith, and are playing a very useful part. Captain Scott's inventive genius has given the guns great mobility, and the ease with which these big pieces are moved from place to place is little short of marvellous. In order that full benefit may be taken of the quick-firing mechanism, a system of anchoring the mountings has been devised. By means of a stout wire and grapnel, the recoil of the mounting is prevented, the carriage being quite strong enough to allow of this. There are also several naval guns locked up with the force in Ladysmith, including a 4·7 mounted on the carriage of a 6-in. howitzer, with the recoil gear for a fixed platform removed.

THE S.S. "KOREA."—CEREMONY OF THE VESSEL BEING BLESSED BY A RUSSIAN PRIEST.

Portsmouth Dockyard.

The *Pandora* has at last been floated out of dock, and a commencement has been made upon the construction of the armoured cruiser *Kent*. This vessel is to be of 9,800 tons displacement, and is almost the last of her class to be put in hand. An ample supply of material has been prepared, and it is hoped that before April considerable progress will have been made with the vessel, although it will be quite twelve months before she takes the water. Five torpedo-boat destroyers, with a speed of 30 knots, have been delivered at this yard during the month. They have all been built by the Clydebank Shipbuilding Co., and carried out their steam trials on the Clyde. They are the *Vulture*, *Kestrel*, *Electra*, *Brazen*, and *Recruit*. All these vessels are to be prepared for sea as early as possible. The number of vessels now in this dockyard is so great that an extension will have to be made before long. One ship, however, which has been got rid of is the *Invincible*, which has been sent round to Sheerness as an extra torpedo school. She has been equipped with a few small quick-firing guns, but the money spent in this direction could have been much better laid out on more modern vessels. The new Royal yacht is now being overhauled, and it has been found necessary to supply new plates in place of those dented in, as the vessel heeled over in dock at Pembroke. The ships of the Channel Squadron have also required a good deal of attention, for the list of defects seems to have no end. All the alterations sanctioned during the last 18 months were to be carried out by the 27th ult. Considerable satisfaction has been expressed at this yard on the promotion of the chief engineer, Mr. J. T. Corner, to the post of inspector of machinery. It is to hoped that Portsmouth will still have the benefit of his services.

Increasing the German Navy.

An extraordinary article recently appeared in the *Deutsche Heeres-Zeitung*, in which an increase in the present strength of the German Navy is very strongly advocated, and curiously enough, the article is published in connection with the trouble in South Africa. In the opinion of the writer, Germany must have a far more powerful fleet than she at present possesses, or on the other hand must be contented to be a second-rate Power in the world. Frederick the Great, says the writer, found his difficulties vastly increased, by the want of pontoons for his bridges, and a great many more lives were lost on this account than were necessary. Possibly the writer intended to compare the pontoons needed at the battle of Moldau to the warships which Germany is in need of at present, in order to carry out her colonial enterprises. The article goes on to say that England possesses one sixth of the land, and the whole of the sea of the world. In the opinion of many other German critics, the only way in which German colonial policy can be pursued is by means of a strong navy. The declaration of Prince Hohenloe that it is the intention of the German Government to double the fleet of battleships, has roused, among other Powers, Austria, and almost daily in the Austrian Press may be found articles advocating the extension of the fleet of the Dual Monarchy.

The Navy and Wireless Telegraphy.

Since the value of wireless telegraphy for naval uses was demonstrated some few months ago when the naval manœuvres were in progress, considerable attention has been given to this form of communication by the naval authorities. Experiments have been continually in progress, and several vessels have been fitted with the Marconi apparatus. The *Canopus* for instance, has been fitted with an installation of the system, and should therefore be particularly useful in the Mediterranean. In the Channel Squadron there will be when the fleet assembles early this month, at least four vessels able to communicate with each other by means of the wireless telegraphy. Both flagships have an installation as well as the *Hannibal* and *Jupiter*, and in all probability, the whole of the ships constituting the squadron will be fitted with the apparatus. A new course has also been added to the signalling school, every man passing through being instructed in the use of the Marconi instrument. Lord Charles Beresford, too, the new second-in-command on the Mediterranean station, has taken a course of lessons at Portsmouth, where Captain Jackson has been making some independent experiments from a gunboat at sea, and the *Hector* in Portsmouth Harbour. However, now that he is commanding the *Vulcan* he will probably carry out many experiments with the new system of signalling from that vessel, in which he will have the support of a staff of skilled mechanics. In the opinion of the United States Navy Board wireless telegraphy is good for squadron signalling, being unaffected by darkness or weather, the only drawback being that two transmitters working simultaneously interfere, but Signor Marconi claims to have a method in reserve for overcoming this drawback. The Board recommends a trial of the system in the American Navy.

Devonport Dockyard.

The chief attention at this yard for the past month has been directed to the completion of the *Ocean*, *Implacable*, *Bulwark*, and the first-class battleship *Montagu*, which was commenced in November last. As regards the *Ocean*, overtime has been worked on her nightly, as it was intended on the 26th ult. to transfer her to the Fleet Reserve, and to commission her on the 20th of this month to relieve the battleship *Hood* in the Mediterranean. Almost every week consignments of armour for the *Implacable* and general material for the *Bulwark* come to hand. When the *Hood* returns she is to undergo a refit costing over £15,000, and is to be prepared for service with the Reserve Squadron. An effort has been made at last to clear away some of the obsolete specimens of naval architecture from this yard. Negotiations have at last been completed for the sale of the obsolete cruisers *Carysfort*, *Shannon*, *Prince Albert*, and *Constance*. The congested state of the Hamoaze has been the cause of much serious concern for some time, and it is hoped that before long some more of these ancient vessels will be cleared away. There was another scare in the store department last month in consequence of 250 gallons of oil being reported to have disappeared in one night. However, it was subsequently discovered that no oil was lost at all, and that merely the readings of the gauge indicator of one vat showed the contents to be less than indicated on the previous night. The instrument, it was discovered, had been affected by the cold weather, and had not acted properly.

The Speed of the "Viper."

It has been decided to send the *Viper* to Devonport, there to equip her for sea service, and to prepare her for a series of experimental trials. This vessel, it will be remembered, was built by Messrs. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, and she is fitted with engines on the turbine principle, constructed by the Parsons Steam Turbine Co. She was ordered to be built by the Admiralty, principally for experimental purposes, and she is intended to attain a speed of 33 knots. She was designed in 1897, but was not launched until September last, the subsequent time being occupied in getting her machinery on board. The propelling machinery consists of four steam turbines, each driving a separate shaft, fitted with two propellers of 3 ft. 4 in. diameter, and 4 ft. 6 in. pitch. The speed of the turbines at the maximum power is 1,000 revolutions per minute, steam being supplied by four Yarrow water-tube boilers. The vessel has a length of 210 ft., with 21 ft. beam, and is built on lines which are an exact copy of the destroyers of the *Mermaid* type. The steering capabilities of the *Viper* have been tested, and are said to be perfect, and at a trial in the North Sea a mean speed of 35½ knots was obtained. At present, therefore, she holds the record of being the fastest ship in the Navy, possibly in the world, and the results of the experimental trials will be eagerly looked forward to.

Rear-Admiral Melville's Opinion of Naval Engineers.

A most interesting letter has just appeared in an evening contemporary, written by Rear-Admiral S. W. Melville, engineer-in-chief of the United States Navy, who naturally holds a very high opinion of naval engineers, dealing with the pay of British naval officers generally. Rear-Admiral Melville is of opinion that there has never been any such question in the United States Navy as seems to obtain in the British service, of officers of the same rank and length of service getting such different rates of pay, and, indeed, while there was at one time a difference in the rates of pay of the line and staff officers, due to the fact that the staff did not attain the flag rank, even that matter was satisfactorily settled to all concerned last spring by the passage of the Personnel Bill, which put all sea-going officers absolutely on the same basis as to pay, rank for rank. It is pretty generally conceived in the United States that, after the commanding officer, the most important man on a modern battleship is the chief engineer, and this, it is claimed, was shown with remarkable clearness in the case of the *Oregon* at the battle of Santiago. Rear-Admiral Melville considers that, apart from justice, a mere worldly policy would dictate proper payment for such important men as the engineers of our big ships, because, otherwise, there is the constant tendency for them to look for more lucrative work outside the service. The United States has experienced the loss of some of its best engineers for this very reason, private firms being willing to pay so much higher compensation than they could ever hope to have received in the navy. Since the passage of the American Personnel Bill, which not only gave a fairer scale of pay, but also an assured rate of promotion, there have been very few resignations. "I wish," says the Engineer-in-Chief of the United States Navy, "my English friends every success in their efforts to get their pay properly adjusted, and can say, as a result of our own experience, that patience, combined with persistent effort, will be rewarded at last.

Chatham Dockyard.

Good progress is being made on the new battleships *Venerable*, *Irresistible*, and *Goliath*, completing at this yard, and also with the building of the *Albemarle*, which was laid down officially on the first day of the present year. The *Albemarle* is building on a slip only 360 ft. long, so that the vessel itself projects 80 ft. beyond the slip. Although this yard possesses five slips, there is only one on which large vessels can be constructed. A new slipway was provided for in the current year's estimates, and £100,000 was voted for it, but at present there are no signs of a start being made with the work. Every effort is to be made to build as much material as possible into the hull of the *Albemarle* before the end of the present financial year. As regards the *Venerable*, which was launched in October last, she has now received nearly the whole of her armour, which has been fixed in position, and the machinery is arriving daily. The *Irresistible* was practically ready for her steam and gun trials several weeks ago. These trials were to have taken place in October last, and the *Irresistible* was to have been commissioned by April, but the non-delivery of her barbette armour upset all these plans. She will not be ready for sea for at least six months. The *Goliath* is not, after all, to relieve the *Centurion* on the China Station, but is to replace the *Victorious*, and this vessel will return to the Mediterranean. Amongst the vessels refitting at this yard was the *Blenheim*, which has now been placed in the Fleet Reserve, the *Archer*, which is ready to be passed into the Medway Reserve, and four vessels belonging to the Chatham division of the Channel Squadron. The *Blenheim* will probably take the place of the *Eclipse* on the East Indies Station. The *Northampton* is to be ready in two months' time to resume her recruiting duties.

The Right of Search.

The British cruisers in the neighbourhood of Delagoa Bay have been displaying a praiseworthy assiduity in the capture and searching of foreign merchant vessels, in which it is suspected contraband of war is concealed. Despite their vigilance, however, guns and ammunition continue to pour into the Transvaal. A writer in the *Times* remarks the configuration of the coast seems fortunately to render it difficult for ships making for Lourenco Marquez to defeat the vigilance of our cruisers by hugging the land and reaching their destination within the shelter of Portuguese waters. This may be the case with vessels making for Lourenco Marques, but there are without doubt numbers of vessels which have been and are unloading cargoes of food and ammunition intended for use by the forces of the Transvaal and Orange Free State Republics. German merchant vessels suspected of carrying guns and ammunition, and American vessels with cargoes of flour have been stopped on suspicion that their cargoes are intended for use by the enemy, but have been subsequently released, and compensation will have to be paid to their owners for damage by detention. The difficulty which the authorities have to contend with at present is to prove that the goods carried by the suspected vessels are intended for the Boers. The cargoes in most cases are consigned to agents in Portuguese South Africa, who have no trouble in forwarding the consignments across the Portuguese border and overcoming the vigilance, real or imaginary, of the officials at Delagoa Bay.

The Naval Strength of the Powers.

Some interesting facts and figures relating to the naval strength of different countries were recently given in a Parliamentary paper. According to this paper Great Britain has 53 battleships built, against 43 of France and Russia combined, and 17 building, against 16 of France and Russia combined. Of armoured cruisers, we have 31 built and building, against 32 built and building of our two principal rivals on the sea. Then we have 116 protected cruisers built and building, against 52 of these two countries, and 15 unprotected against 17 French and Russian vessels. Of course, amongst the 53 battleships built there are many ancient vessels and several armed with muzzle-loading guns; therefore the figures are a little misleading to the man in the street. The comments on the return published in the daily press are most interesting. The *Times* points out that it is the fixed and unalterable policy of this country to have a fleet able to meet the combined fleets of any two powers on at least equal terms, and the steady increase of the naval armaments of Germany necessarily tends to bring that country more prominently into the comparison than heretofore. The *Pall Mall Gazette* asserts that the figures are delusive owing to the fact that we still keep in the list of effective ships, 16 battleships and eight armoured cruisers, armed with muzzle-loading guns, and protests against the stuffing of the Navy List with such "hoary shams." The general opinion, however, seems to be that the return is a very just one, and that the inclusion of obsolete vessels belonging to other countries makes the return a very fair official estimate of naval strength.

Pembroke Dockyard.

The keel of the first-class cruiser *Essex*, was officially laid down on the first day of the present year. A good deal of material has been got together ready to be worked into her hull, and a great deal more would have been prepared if the new Royal yacht had not engaged the attention of so many hands. The *Essex* is what may be termed a commerce protector, for she is to be fitted with engines of 22,000 H.P., and is expected to maintain a speed of 23 knots for eight hours on the contractors' trials. Condensers are to be fitted to the Belleville boilers, and stowage will be provided for 1,000 tons of coal. She has two sister ships building, the *Kent*, and the *Bedford*. The departure of the Royal yacht has released a great number of men, who have been sent to the *Spartiate*, and this ship may therefore be expected to make rapid headway. When the accident happened to the *Victoria and Albert*, shipwrights were drawn from every other vessel in hand to assist in righting her, and when she was at last towed clear of the dock, loud cheers were given, in which Sir William White is said to have joined.

Admiral Cervera's Dash from Santiago.

The official and personal correspondence which Admiral Cervera received permission from the Spanish government to publish as a defence of his conduct in the Spanish American war, has been translated and published by the United States naval intelligence office. In this correspondence, Admiral Cervera states that he reported on April 24th, 1898, that the *Viscaya*, on account of her foul bottom, was "no better than a buoy." We also learn that it was decided that he should escape from Santiago Harbour a week after his arrival, but the departure was postponed owing to a storm. Finally the Admiral practically refused to leave the harbour on his own responsibility, saying that "it is for the Captain-General to decide whether I am to go out to suicide, dragging along with me those 2,000 sons of Spain." The correspondence also shows that the original suggestion to escape came from Marshal Blanco in a telegram to General Linares, "it is my opinion that Cervera should go out from Santiago as early as possible." But Cervera was aware of the great risks he ran in pursuing such a course, and therefore declined to attempt to escape unless he received orders to that effect from Marshal Blanco. Blanco settled the case by cabling to the Government at Madrid, who at once adopted his view. The crews were therefore re-embarked, and on July 3rd, the ships put out to sea, and with what disastrous results is now well known,

Additions to the Fleet.

The keel of the new third-class cruiser which is to be constructed at Devonport Dockyard is to be laid almost immediately, and her principal dimensions will be:—Length, 310 ft.; breadth, 36 ft. 6 in.; mean load draught, 13 ft. 6 in.; displacement, 2,200 tons. Her engines will develop 7,000 I.H.P., which will give her a speed of twenty knots an hour. Her armament will consist of eight 4-in. and eight 3-pounder quick-firing guns, two Whitehead torpedo dischargers, and four Maxim machine guns. The total cost of the vessel when completed for sea is estimated at about £145,000. The report of Earle's Shipbuilding Co., issued a week or so back, shows a loss of £50,000 on the year's working, which arises in great measure from the abnormal costs of constructing the new cruisers *Perseus* and *Prometheus*, the first of which is completing at Sheerness, and the second named awaiting transfer to the Fleet Reserve. These vessels, say the directors of the company in question, were contracted for in 1896, when work was scarce and prices were low, and their cost has been affected by labour strikes, and also by the rise in wages which has taken place within the last three years. In these vessels, it may be mentioned, the amount of woodwork has been very much reduced, as is the case with all other vessels commenced within the past few years, although we have not taken wood out of ships built previous to the Spanish-American War. The removal of woodwork, of course, means wrecking the interior of the ships, and, if this is to be done at all, it should not be left until the outbreak of war.

Sheerness Dockyard.

The *Perseus* and *Prometheus* are at last almost ready for transfer to the A Division of the Fleet Reserve. It may be pointed out that nearly four years have gone by since the laying of their keels, although they are only third-class cruisers, with a displacement of a little more than 2,000 tons. Great activity has been apparent on the *Rosario*, owing to her being prepared for her steam trials. The dockyard engineering staff delivered the machinery for the *Rosario* a little later than that delivered by the Thames Shipbuilding Co. for the *Condor*, but the *Rosario* was ready for her trials first, although men were kept working overtime until very late hours at night. The *Rosario* is the first sloop to be fitted with water-tube boilers, and both she and the *Condor*, *Vestal*, and *Shearwater* have been fitted with boilers of the Belleville type. The keels of the new sloops *Fantome*, and *Espiegle* were laid about two weeks ago. The *Fantome* has been commenced in No. 5 dock, but she will have to be floated into No. 2 dock before she can be completed, as the first named dock is not of sufficient length to allow of her being completed in it. Amongst the vessels undergoing refit here is the torpedo-boat destroyer *Snapper*. She is to have her boilers retubed, so that it will be some time before she is out of the dockyard hands. The *Hearty* is also undergoing her annual refit, and the *Sparrow* is to be taken in hand as soon as possible.

Engines for Warships.

According to the returns of the leading firms engaged in the construction of machinery for warships, the past year has been in every respect a busy and prosperous one. At many of the establishments double shifts and overtime has been continuous, for in many cases, in addition to supplying the engines, the firms have built the vessel for which these are intended, and where vessels are built in the Royal dockyards, the contracts for the engines have in nearly every case been given to private firms. The Thames Ironworks and Shipbuilding Co., in which is now incorporated the business of Messrs. John Penn & Sons, has had its full share of Government work. The firm has turned out machinery at least for three battleships, including the *Duncan*, *Cornwallis*, and *Albermarle*, the engines of all three ships having a horse power of 18,000. Messrs. John Penn & Sons, before they joined hands with the Thames Ironworks Co., constructed the machinery for the *Goliath* and the third-class cruiser *Pomone*. Messrs. Humphreys, Tennant & Co. were fortunate in securing the contracts for the engines of the new Royal yacht, and the machinery of the Japanese battleship, *Shikishima*, and the Japanese cruisers *Asama* and *Tokiwa*, whilst Messrs. Maudsley Sons & Field delivered the engines for the battleship *Albion*, and for the cruiser *Spartiate*. Messrs. Yarrow & Co. have been responsible for the engines of five 31-knot torpedo boat destroyers for the Japanese Navy, two torpedo boats for the Austrian Government, and the machinery for a few shallow draught steamers. The aggregate I.H.P. of the marine engines completed on the Clyde last year amounted to 478,503, which is some 30,000 less than that of the previous year. Messrs. John Brown & Co., Limited, have delivered engines with an aggregate horse power of 53,480, and the Fairfield Co. of 51,650, the work carried out by Messrs. John Brown included the engining of the Japanese battleship *Asahi*, and the first-class British cruiser *Sutlej*. The Vickers Co. at Barrow-in-Furness, have been responsible for the engines of the *Vengeance* and six other vessels.

The Launch of the "Pandora."

The third-class cruiser *Pandora* was christened and floated out of Portsmouth Dockyard about a week ago. This vessel, it will be remembered, was laid down on January 3rd, 1898, so that she has been a little over two years on the building slip. However, the fact that she has been built in dock has allowed of her being brought to a more advanced state of completion than would have been the case had she been built on a slip. She is one of two third-class unsheathed protected cruisers now building, the other vessel being the *Pioneer*, now under construction at Chatham. Mrs. Napier, the daughter of Admiral Sir Michael Culme Seymour, Commander-in-Chief at Portsmouth, officiated at the christening ceremony when the vessel took the water. The principal dimensions of the *Pandora* are: length, between perpendiculars, 305 ft.; length, over all, 318 ft. 6 in.; breadth, extreme, 37 ft.; mean draught of water, 13 ft. 6 in.; displacement, 2,200 tons. A steel deck sloped at the sides, and varying in thickness from $\frac{1}{2}$ in. to 2 in., has been worked throughout the length of the ship in the neighbourhood of the water line, forming a watertight boundary, and affording protection to the engines, boilers, magazines, &c. The *Pandora* will be propelled by twin screws, each driven by an independent set of vertical triple-expansion engines, capable of developing, at the working pressure of 250 lbs. to the square inch, an I.H.P. of 3,500 or 7,000 for the two sets of engines. With this H.P. a speed of about 20 knots will be realised. Steam will be supplied by eight water-tube boilers of the Thornycroft type. These engines and boilers are being built in Portsmouth Yard. The quantity of coal carried at the above draught is 250 tons, although provision is made for stowing a much larger amount. The armament will consist of eight 4-in. quick-firing guns—two being on the forecastle, two on the poop, and the remainder in the waist of the ship—eight 3-pounder quick-firing guns, and three ·45-in. Maxims. Two above-water torpedo-tubes will be carried. These tubes will be armoured, the thickness of the armour varying from 1 in. to 3 in. The complement of the *Pandora* when commissioned will be 224 officers and men.

RIPPER'S MEAN-PRESSURE INDICATOR.

THE accompanying illustrations show a new departure in indicators for steam engines, designed and patented by Professor William Ripper, and manufactured by Messrs. Schäffer & Budenberg, Whitworth Street, Manchester. Professor Ripper first brought forward his new invention before the Institute of Mechanical Engineers at a recent meeting, of which a report was given in our last issue; but he has since further developed the apparatus, and introduced important improvements in its construction, which we are now able to set fully before our readers. In this instrument the mean pressures acting on the two sides of the engine piston are indicated continuously on the separate dials of the pressure gauges, the reading of one gauge being the mean effect of the driving pressures acting on the piston, and the reading of the other the mean effect of the back pressures acting against the piston; the difference between the two readings representing the mean effective pressure on the piston. Considering the very great importance of Professor Ripper's invention, especially to marine engineers, the two sets of illustrations we are enabled to give will be of interest. Our illustration Fig. 1 shows the indicator as it had been designed and perfected by the Professor up to the time of reading his paper before the Institution of Mechanical Engineers, although this particular type of the indicator was not brought before the meeting. Our illustration Fig. 2 shows the further improvements since introduced by Professor Ripper, in some measure as the result of the criticism and discussion at the above meeting, one new feature being the dirt-collecting pockets, whilst there has been a considerable strengthening of the apparatus in other parts. The form shown in our sectional illustration is adapted for use on vertical engines, and is supplied with coupling nuts *A* and *B* for $\frac{3}{8}$ in. or $\frac{1}{2}$ in. bore brass pipes for connecting the instrument to the indicator pipes or direct to the cylinder ends. If it is desired to use $\frac{3}{4}$ in. bore connecting pipes the instrument is fitted with a special coupling nut. The pressure gauges are connected with the valve box by copper pipes *C* and *D*, and fine regulating valves *E* and *F* serve for throttling the pressure gauges; whilst there are two throttling cocks *G* and *H* on the valve box for the purpose of initial throttling to prevent the disappearance of the water from the gauge syphons. Screwed plugs *J* and *K* are provided for blowing through the instrument when required and for filling the syphons with water. The constant communication of the forward-pressure gauge with the forward-pressure side of the piston is secured by a ball valve *M*, which is pushed forward at the end of every stroke by the greater pressure of the incoming steam, thus making communication between the gauge *P* and the high-pressure side of the piston, and closing the communication to the other side of the piston. Similarly a double-beat valve *N*, under the action of the steam, makes the communication between the back-pressure gauge *Q* and the back-pressure side of the piston; *S* and *T* are dirt-collecting pockets, which are cleared by removing the plugs *V* and *W*. This instrument, which is automatic, and requires no driving gear, will give for all ordinary cases a very close approximation to the result obtained with an ordinary indicator; but in engines sometimes working under a very large and varying degree of compression, such as locomotive engines, an error is introduced, owing to the reversal of the valves taking place too early in the stroke, and a special arrangement has been designed to obviate this difficulty. The Ripper indicator possesses, amongst other advantages, that of enabling the load at which the engine is running to be seen at a glance; and in compound or triple-expansion engines it shows whether the load is evenly or unevenly distributed over the different cylinders. It is also readily ascertained how far above or below the "rated load" the engine is working, whilst the power required to drive any machine or portion of a workshop can be

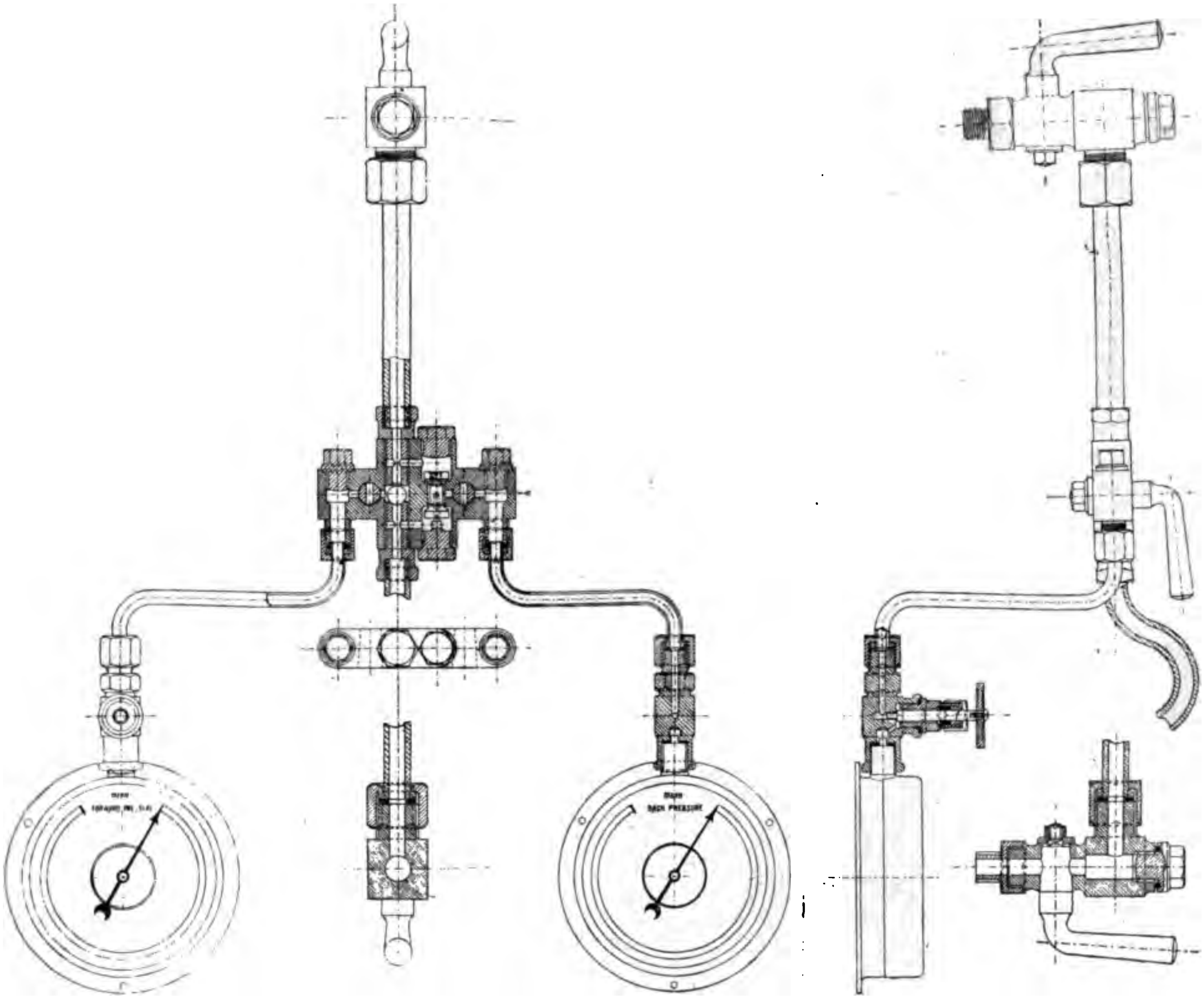


FIG. 1.

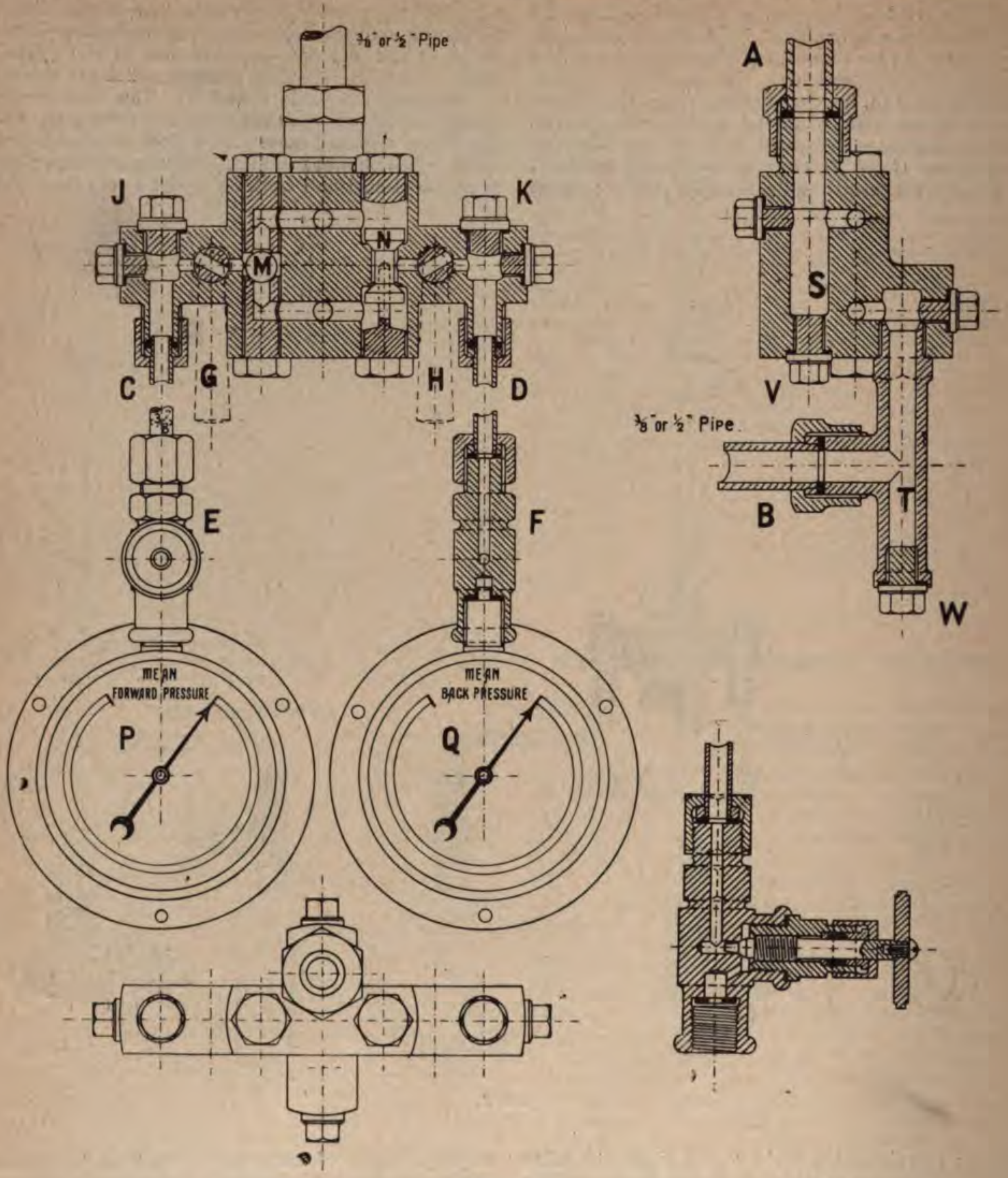


Fig. 2.

easily determined by noting the differences in the reading of the gauges when the respective loads are "on" and "off." If anything has suddenly gone wrong with the engine, it is possible, with the aid of this instrument, to at once locate the fault, or to see whether the fault is within the engines or outside them. By closing one admission cock to the instrument whilst the other is open, and afterwards reversing the operation, an equal, or nearly equal, reading of the forward-pressure gauge in the two cases respectively will show that the main valves of the engines are properly set. For marine work in particular the instrument should be found extremely useful in enabling the chief engineer of a steamship to satisfy himself at a glance at any moment, and without the necessity of "indicating," as to the actual power the engines are developing; and to see whether the power is distributed equally over the different cylinders, so as to always ensure the greatest possible uniformity of the turning effort on the engines, which not only tends to steady working of the engines, but also ensures more uniform pressures on the bearings. If the engineer alters the link motion of the engine, he can see at once what is the effect upon the total power and the distribution of the power of every change in the position of each link. It also appears likely that this instrument will be found extremely useful in connection with trial trips in giving a continuous record of the power developed by the engines, thereby saving an immense amount of labour now expended on the frequent indicating of the engines, and showing instantly every change of power.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from November 27th to December 21st, 1899:—

Rattey, W., engineer to the *Duke of Wellington*, for the *Bullfinch*, to date November 10th, in lieu of a chief engineer.

Screech, S. A., chief engineer to the *Monarch*, for transport staff, to date November 30th.

Screech, S. A., chief engineer, to be staff engineer, to date December 1st.

Shean, F. E., inspector of machinery, has been placed on the retired list.

Shirvell, J., fleet engineer to the *Highflyer*, to date December, 7th.

Sillince, W. P., assistant engineer to the *Highflyer*, to date December 7th.

Skinner, W. H., fleet engineer to the *Vivid*, for the *Talbot*, to date November 24th.

Smith, F. P., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Stevens, W. C., engineer to the *Victoria and Albert*, for the *Alberta*, to date November 23rd.

Swinney, E., chief engineer to the *Scout*, to date December 5th.

Taylor, G. R., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Walker, J. J., fleet engineer to the *Royal Arthur*, for the *Katoomba*, lent to the *Ringarooma*, to date December 12th.

Ward, J. T. H., chief engineer to the *Pembroke*, for the *Northumberland*, to date December 12th.

Ware, C. G., engineer to the *Furious*, to date November 10th.

Warren, C. L. (probationary), assistant engineer to the *Indefatigable*, and for recommissioning, to date December 12th.

Whebby, T., fleet engineer to the *Hotspur*, to date November 30th.

Wise, F., engineer to the *Pembroke*, for the *Cyclops*, to date November 25th, in lieu of a chief engineer.

Wooldridge, G. W., assistant engineer to the *Highflyer*, to date December 7th.

From December 22nd, 1899, to January 23rd, 1900:—

Abbott, H., chief engineer to the *Duke of Wellington*, for the *Pandora*, to date February 20th.

Abbott, W. J., fleet engineer to the *Duke of Welligton*, for the *Neptune*, to date January 10th.

Agnew, T., fleet engineer to the *Vivid*, for service in Reserve Office, undated.

Alexander, J. W., assistant engineer to the *Ramillies*, to date January 1st.

Amor, Edward R., assistant engineer to the *Vernon*, additional, for torpedo store, to date January 2nd.

Anderson, W. J., chief engineer to the *Duke of Wellington*, for the *Gladiator*, to date January 5th.

Anstey, H. C., engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Aston, S., staff engineer to the *Pembroke*, for the *Diana*, to date January 4th.

Baldwin, G. W., engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Baron, R., engineer to the *Pembroke*, for the *Cygnet*, to date December 21st.

Barker, H. C. D., assistant engineer for temporary service, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Cleave, Richard C., assistant engineer to the *Galatea*, to date January 1st.

Corner, John T., fleet engineer, has been promoted to the rank of Inspector of Machinery, in her Majesty's fleet.

Cornish, E., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Cunningham, J. E. G. (probationary), assistant engineer to the *Vivid*, additional, for the *Ocean*, to date January 15th.

Dalrymple, J. H., chief engineer to the *Vivid*, additional, for the *Rainbow*, to date January 1st.

Drake, P. G., engineer to the *Pembroke*, additional, for the *Spitfire*, to date January 1st.

Eyre, C. V., engineer to the *Pembroke*, additional, for the *Bittern*, in lieu of a chief engineer, undated.

George, F. T., staff engineer to the *Theseus*, additional, and as part complement on recommissioning of *Ramillies*, to date January 4th.

Gordon, H. V. (probationary), assistant engineer to the *Majestic*, to date January 1st.

Griffin, D., fleet engineer to the *Duke of Wellington*, for the *London*, to date January 20th.

Guyer, F., acting engineer to the *Wildfire*, for general duties in Sheerness Dockyard Reserve, to date December 21st.

Hammond, H., assistant engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Harding, R., fleet engineer to the *Vernon*, additional, for torpedo-boats and such tenders as have no engineer officers attached to them, to date January 5th.

Haves, J. E., engineer to the *Pembroke*, additional, for the *Cheerful*, undated.

Hefford, E. O., engineer to the *Hibernia*, for service in connection with gun mountings, to date December 22nd.

Hicks, J. A. H., staff engineer to the *Duke of Wellington*, additional, for the *Rodney*, to date January 10th.

Holgate, G. S., engineer to the *Ramillies*, undated.

Hopkyns, J. W., assistant engineer to the *Northampton*, to date January 1st.

Huddy, J. B., engineer, has been placed on the Retired list of his rank

Hughes, T. C. E., staff engineer for the *Duke of Wellington*, for the *Hecla*, to date January 5th.

James, F. W., has been appointed assistant engineer R.N.R.

Jenkins, J. E., staff engineer to the *Diadem*, to date January 5th.

Johnson, H. H., assistant engineer to the *Vivid*, for the *Ocean*, to date January 10th.

Leighton, W. J., engineer to the *Research*, to date January 10th.

Lewis, E. E., engineer to the *Magnificent*, to date January 1st.

Lobb, H. T. G., assistant engineer to the *Resolution*, to date January 1st.

Lock, H. J., fleet engineer, has been placed on the Retired List of his rank at his own request.

Lyon, W. H., has been appointed engineer R.N.R.

Markham, R. G. L., engineer to the *Vulcan*, to date December 22nd.

Mathew, G. W. (probationary), assistant engineer to the *Devastation*, to date January 10th.

Matthews, W. H., fleet engineer to the *Duke of Wellington*, additional for the *Inflexible*.

Meiklem, R. A. R., assistant engineer to the *Europa*, to date January 10th.

Moore, F. J., fleet engineer to the *Pembroke*, for the *Ajax*, to date January 4th.

Moorshead, H. B., engineer to the *Vivid*, for the *Osprey*, to date January 1st.

Morgan, T. J., engineer to the *Mars*, to date January 1st.

Moss, F. S., engineer to the *Vivid*, additional for tender *Ferret*, to date January 1st

Newton, W. W., assistant engineer, for temporary service to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Nicholls, H. E., assistant engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

O'Dougherty, H. B. (probationary), assistant engineer to the *Vivid*, supernumerary, to date January 17th.

Olive, W. E. (probationary), assistant engineer to the *Cæsar*, to date December 22nd.

Paton, F. C. R. (probationary), assistant engineer to the *Orlando*, to date January 17th.
Pring, F., engineer to the *Duke of Wellington*, for the *Glory*, to date January 10th.
Pulliblank J. B., (probationary), assistant engineer to the *Illustrious*, to date December 22nd.
Rashbrook, H. S., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.
Rashbrook, H. S., fleet engineer to the *Wildfire*, for the *Edinburgh*, to date January 10th.
Reynolds, H. E. J., acting engineer to the *Pembroke*, for the *Sparrow*, to date January 19th.
Richards, P. B., assistant engineer, for temporary service, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.
Richards, P. B., assistant engineer to the *Duke of Wellington*, supernumerary temporary, to date January 10th.
Sawyer, Arthur F., assistant engineer to the *Hannibal*, to date January 1st.
Scott, E. B. (probationary), assistant engineer to the *Diadem*, to date January 10th.
Screech, S. A., chief engineer, has been advanced to the rank of staff engineer, in her Majesty's fleet.
Scullard, G. H., assistant engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.
Simmons, G. T., fleet engineer to the *Ramillies*, undated.
Spence, R., engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.
Start, S. P., assistant engineer to the *Ramillies*, to date January 1st.
Summerford, H. G., engineer to the *Pembroke*, for the *Goliath*, to date January 2nd.
Sutton, A. W., engineer to the *Tamar*, for charge of engineers' reserve stores, and to assist inspector of machinery at Hong Kong, to date January 17th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE tonnage presently under construction in Clyde yards—which in last month's Notes was stated to amount to about 450,000 tons gross measurement—has been reduced by a number of launches (one or two of considerable note) since the resumption of work after the New Year holidays. Altogether considerably more than the average January output has taken place, one item alone, the Allan Line twin-screw *Tunisian*, amounting to 10,200 tons. Compensating for this, however, there has been a gratifying amount of new tonnage placed, East Coast of Scotland, as well as Clyde firms, sharing in the contracts. About 40,000 tons in all have been ordered, particulars of the contracts being given in the course of these Notes.

Messrs. William Simons & Co., Renfrew, whose 12,000 tons of output during the year now numbered with the past embraced several very notable vessels for dredging purposes, have early in the new year begun to consign the work they have in hand to the water. Early in the month, and the year, they launched complete a steel twin screw hopper dredger, named the *Shunkai Maru*, No. 1, constructed to the order of the Osaka Harbour Board, Osaka, and intended for work in connection with the improvement of that Japanese port.

Other noteworthy contributory items to the month's aggregate output are two sailing ships, these being the first vessels of the sailing order to be launched in Scotland for a number of years—except, of course, small coasting or fishing craft and sailing yachts. Both vessels, moreover, are of a type very unusual on this side of the Atlantic, although common enough on the American seaboard, being four-masted schooners, the masts being all of about the same height, and fitted with fore-and-aft sails only. These and other features connected with the rig are designed to enable the vessels to be worked by the minimum number of hands. One was launched by the Grangemouth Dockyard Co. for Mr. W. L. Lovitt, of Yarmouth, Nova Scotia; and the other by Messrs. R. Duncan & Co., Port-Glasgow, for Mr. John Ena, of Honolulu, for whom they have already built one similar vessel. Both vessels are constructed with very clear holds for the stowage of large cargoes of timber.

The Fairfield Shipbuilding and Engineering Co., Limited, has contracted with the Isle of Man Steam Packet Co. to build and engine a fast paddle steamer for that Company's Isle of Man passenger service. The new vessel will be somewhat similar in size and design to the paddle steamer *Empress-Queen*, built about three years ago for the Isle of Man Company, which is at present lying in the Fairfield Co.'s tidal dock.

Messrs. A. Stephen & Son, of Linthouse, and Messrs. Barclay, Curle & Co., Whiteinch, are to share, in some measure, with Messrs. Caird & Co., Greenock, the requirements in the way of new tonnage of the Peninsular and Oriental Co. This vast and enterprising concern has not for many years gone to any other builders on the Clyde than Messrs. Caird & Co. for new vessels, but they have recently placed orders in all for four large steamers. Two of between 7,000 and 8,000 tons have been placed with Messrs. Caird, who have already three other vessels on hand for the company, and one each of about 7,000 tons has been placed with the firms above named. Whilst the vessels to be built by the Greenock firm are of the high class mail and passenger type, so many of which have emanated from their stocks, the vessels placed higher up the river are to partake more of the intermediate or cargo carrying class.

Messrs. McKie & Baxter, of Copland Engine Works, Govan, as we mentioned last month, in addition to other work, have in hand six sets of engines, aggregating 3,050 I.H.P., for shipment abroad, some being for Singapore and Colombo, built under the superintendence of Mr. David Pollock, M.I.N.A., 128, Hope Street, Glasgow.

The shipbuilding yard of Messrs. A. Rodger & Co., Port Glasgow, was on Saturday, 20th ult., the scene of a somewhat disastrous fire. This appears to have originated in the joiners' shop, which was a brick building of three flats, and, although the fire brigade was promptly in attendance, the building was soon in flames. Adjoining this building, separated only by a fireproof wall, are the drawing and commercial offices of the firm. For a time it seemed as if the fire, fanned by a strong westerly wind, would spread in this direction, and models, drawings, and valuable documents were removed to a place of safety. The conflagration was happily kept under and confined to the building in which it had originated, and eventually the roof and floors of the shops fell in, several men being injured. The whole of the machinery, much valuable finished work and material were completely destroyed, whilst the walls of the building also collapsed. Besides the joiners' shop, the building comprised the polishing shop, the engineers' and blacksmiths' shops; and these with their contents were completely ruined. The destruction of the main driving engine, &c., has thrown 150 men out of employment. The damage, which is fully covered by insurance, was estimated at £12,000.

Menzies & Co., Limited, of Leith and Inverkeithing, who during 1899 were very busy at their Leith works with ship and engine repairs—two of the biggest contracts being on Her Majesty's ships *Caledonia* and *Redwing*—also had a fair start at their recently acquired shipbuilding premises at Inverkeithing, although hampered, like many other firms, by the slow delivery and high price of materials. The fourth annual general meeting of the company, as a limited liability concern, was held early in this month, when a dividend of five per cent. on preference, and ten per cent. on ordinary shares was declared. The company have in hand at present, at Inverkeithing, two steamers, one a twin-screw steamer of 300 tons, and 800 I.H.P., for owners at Para, and the other a fishing steamer of 220 tons and 700 I.H.P., for Grimsby owners. At their Leith works the company continue to add to the equipment of their extended workshops, modern labour-saving machines, and to their facilities for docking and repairing the hulls and engines of all classes of steamers.

At Dundee, operations in the shipyards and engine shops were duly resumed after the New Year's holidays, and already 1900 has brought some fresh work for shipbuilders. The Caledonian Shipbuilding and Engineering Co., Limited, has received an order to build and engine a screw steamer, 230 ft. long, 36 ft. beam, and 15 ft. deep, for the African Steamship Co.

The shipbuilding yard at Kinghorn, formerly occupied by Messrs. John Scott & Co., and for a number of years past carried on under the same name by Mr. Samuel Crawford, formerly manager at Clydebank shipyard, ceased operations owing to financial difficulties shortly before the end of the year. Between 400 and 500 workmen were employed at the time of the stoppage, they being informed that until further notice their services would not be required. Some time ago, when the yard was very busy, over 1,000 men were in steady employment. Two vessels are at present in course of construction, one of 1,500 tons for a Hull firm, which is well advanced. Most of the workmen have found employment elsewhere, but hopes are entertained that operations at the yard, which is the mainstay of Kinghorn, will soon again be resumed.

In the steel trade there is no finality either as regards increasing facilities for output, or in respect of improved modes and character of manufacture. In all the works of the West of Scotland extensions and alterations have been proceeding, contemporaneously with the conduct of affairs at full pressure to cope with the enormous demand for material which has been pouring in from all sides. Extensions and improvements have been under way throughout last year, and in some cases they have been, or are being still, enlarged upon. Messrs. Colville, of Dalzell Steel Works, Motherwell, are adding to their new plant of steel smelting furnaces. The Lanarkshire Steel Co., Limited, have now almost completed the laying down of a splendid new plant. Many acres of ground have been acquired, and on this has been laid down a 40 in. cogging mill—the largest of its kind in the country—two bar mills, a 36in. and 27in. mill respectively, together with the necessary reheating plant. This will increase the present output of 2,000 tons per week by 300 tons per week. It is expected that the new plant will be partly in operation by the beginning of March. The Calderbank Works have been restarted for the production of ship plates. The Steel Co. of Scotland are continuing to remodel their works, and have to a large extent reconstructed their steel foundry at Newton. The Glasgow Iron and Steel Co. have added two melting furnaces to their plant at Wishaw. Mr. James Riley, who has retired from the management of these splendid works at the expiry of his five years' engagement, and who has purchased steel works at Stockton-on-Tees, has successfully inaugurated there the use of fluid metal taken direct from the blast furnaces and immediately charged into the Siemens melting furnace—many thousands of tons having been thus successfully treated in the course of last year.

The works of Messrs. William Beardmore & Co. have now fully established, as their leading branch of industry, armour-plate manufacture. Not only in this but in other departments of the works the year 1899 was one of extreme pressure. Beginning this year with a full order book, including the large order for side-armour for H.M. *Cressy* and *Aboukir*, and casemate-armour for *Cressy*, *Aboukir*, *Sutlej*, and *Implacable*, which the British Government placed with the firm towards the end of 1898, and the Danish Government's order for the side-armour of their new warship *Herluf Trolle*; the manufacturing and finishing capabilities of the Parkshead plant have been stretched to their utmost capacity. This was particularly noticeable during the latter months of the year recently closed, when the manufacture had reached such a pitch that with the great 12,000 ton hydraulic press and the 4,000 ton press continuously at work, and the rolling, machining, bending, chilling, and finishing processes actually pressing upon each other, the delivery of finished armour reached a total of about 500 tons per month. Such a result was, of course, only attained through the further considerable additions to the finishing machinery, which were made during the past year. Consequent upon their vigorous adoption of armour-plate manufacture, and the great increase in plant thereby entailed, Messrs. Beardmore & Co. have in further contemplation for the immediate future a large extension to their works on ground adjoining their present property.

Lloyd's General Committee have, after some negotiations and correspondence with a committee representing all the bodies interested, agreed to the establishment of a branch committee of the society in Glasgow for the Clyde district, and have referred to a sub-committee the arrangement of details. Last spring the Clyde Steamship Owners' Association communicated with all the bodies in Glasgow who elected representatives to Lloyd's Register Committee, and pointed out that the present representation to Lloyd's from Glasgow was inadequate, considering that in the year 1898 the Clyde district owned 1,918,799 tons, and in the same year 466,832 tons of shipping was produced on the Clyde. The result was that a conference was held of representatives of all the bodies in Glasgow, and the outcome of that conference was a unanimous request being sent to Lloyd's in London requesting that a local committee be established in Glasgow. The constitution of the local committee will be discussed and arranged at a meeting to be held some time this month, and it is thought that this will be regulated in a large measure by the lines laid down in connection with the similar Liverpool branch committee, where there were sixteen members and a chairman ex-officio. Eight of these representatives are sent to London as representing the Liverpool Committee.

The committee of the British Corporation for the Survey and Registration of Shipping have recently made additional appointments of non-exclusive surveyors at the foreign ports herewith named:—Philadelphia, Mr. John T. Boyt, 302, Walnut Street; Cleveland, Ohio, Mr. Robert Logan, 810, Western Reserve Buildings; Suez, Mr. A. G. Austick; Singapore, Mr. A. Kitching; Fremantle, West Australia, Mr. John Denny. At least two of the above-named have had a Clyde training. Mr. Logan was for many years chief draughtsman to the now defunct firm of Aitken & Mansel; and Mr. John Denny, who is a cousin of the Messrs. Denny, of Leven Shipyard, Dumbarton, served his apprenticeship in the works of the Clydebank shipbuilding Co., now John Brown & Co., Limited.

Mr. John Carmichael, until recently of the Greenock shipbuilding firm of Carmichael & McLean, and formerly an assistant manager at Fairfield, has been appointed manager to Messrs. Craig, Taylor & Co., Stockton-on-Tees, whose establishment has undergone great extensions of late.

The Institution of Electrical Engineers has granted the prayer of a petition, on the part of between 70 and 80 gentlemen connected with electrical industries in and around Glasgow, for the formation of a local section of the institution, with its headquarters in Glasgow. In pursuance of this a meeting was held on the 18th ult., in the rooms of the Institution of Engineers and Shipbuilders, Bath Street, Glasgow, at which several of the principal office-bearers of the head institution were present, and arrangements were entered into for the formation of the section. A provisional committee was appointed to draft local rules and to carry on the work of the section till May.

Death has been busy of late amongst the ranks of shipbuilders and engineers of the Clyde district, and has claimed as victims Mr. James Deas, the engineer-in-chief to the Clyde Trust—of whose career and great work on the Clyde something will be said in our next issue—and Mr. Archibald Gilchrist, chairman of the old concern of Barclay, Curle & Co., of Whiteinch and Stobcross, and himself one of the very few remaining shipbuilders whose connection with shipbuilding on the Clyde carries us back to the early days of marine engineering as an industry. Two other men of note who have of late passed away are Mr. A. H. Wilson, senior partner of Messrs. Hall, Russell & Co., Aberdeen; and Mr. John Napier, only surviving son of the famous shipbuilder and engineer, the late Robert Napier, of Shandon, and founder of the great Govan firm of Robert Napier & Sons. Mr. Wilson, who died abroad—at Mentone—on Christmas night, learned iron shipbuilding with Messrs. Barclay, Curle & Co., and about 35 years ago, became a partner in the shipbuilding and engineering firm at Aberdeen. Mr. John Napier, until his retirement, about 20 years ago, from the business founded by his father at Govan, was a well-known and able engineer, and resided at Sauchfield, Gilmorehill, one of the very few remaining old-time Glasgow mansions. After his retirement he took up his residence in London, having investments in various shipping concerns managed there. He died in his 77th year, and his remains were brought to Glasgow and there interred.

The Watt Anniversary Lecture, at Greenock, was, on this occasion, delivered on the 19th ult., in the Watt Institute, by Professor Oliver Lodge, of Liverpool, his subject being "Wireless Telegraphy." On the previous evening he delivered a lecture on the same topic in Glasgow, as one of the course organised by the Glasgow Lectures Association, and in this way interest in the Watt Lecture of 1900 was somewhat miminised, or at least was not so general over Clydeside as on previous occasions. The Watt Dinner, which is more and more becoming the recognised annual festive function of the Institution of Engineers and Shipbuilders rather than as the celebration of Watt's anniversary, was held on Saturday evening, the 20th ult., in the Windsor Hotel, Glasgow. There were about 270 persons present, the chair being occupied by Mr. Robert Caird, F.R.S.E., president of the Instit[illegible] Professor W. H. Watkinson, vice-president [illegible] ex-vice-president, acted as cr[illegible] Sir William Arrol, M[illegible] of H.M.S. *Ben*[illegible]

Captain Usui and other officers of the Imperial Japanese Navy; Mr. John Inglis, LL.D. ; Bailie James M. Thomson, Professor J. H. Biles, Colonel Archibald Denny, and Mr. Edward H. Parker, secretary of Institution. The toast list was shortened somewhat from previous years—even that of the "Memory of Watt" having been expunged—and there was quite an evident effort on all sides to eliminate "shop!" At the conclusion of the toast list the function resolved itself into a smoking concert.

THE TYNE.

(From our own Correspondent.)

Shipbuilding.—The customary lull in business which makes itself felt in the first weeks of a new year is now disappearing, and briskness is again becoming the preponderating feature in all the principal industries. Under other circumstances the sudden and extraordinary rise in the price of coal might have checked business in the shipbuilding and engineering trades for a time; but such an effect is not discernible on the present occasion, the reason being doubtless that there are too many orders in hand, and owners are too urgent for prompt delivery, to admit of any delays being indulged in by builders which could by any means be avoided. The dearness of coal will, of course, have its effect on the prices of work now offering, and we should imagine that it will be impossible to place orders, excepting at considerably enhanced prices as compared with those prevalent in December, 1899. In these notes, the probability of this contingency arising has been foreshadowed on more than one occasion towards the close of last year, and the circumstance has consequently not occasioned us any surprise. If we may again venture upon the hazardous task of prediction, we think it will not be far from the truth to say that the cost of new tonnage is likely to be further advanced in the immediate future, and that many months will elapse before the inevitable retrograde movement begins to show itself.

It appears that, through the desire of some shipbuilding firms to occupy more prominent positions in the output lists than they were entitled to, the returns of tonnage built last year are somewhat exaggerated. In certain districts, indeed, where an increase upon the previous year's record was announced; it turns out that instead of an increase of output there was a decrease. It is a pity that, for the sake of a little brief notoriety, firms of good and honourable standing in the shipbuilding world, should resort to the misleading tactics mentioned, and we sincerely hope they will in future see the uselessness of such a proceeding. There is one legitimate mode of measurement by which the tonnage of all vessels built is determined, and nothing but this true standard should be recognised. If every builder is permitted to put fancy measurements of his own before the public as indicating the output from his establishment, it will become impossible to place any reliance on published lists, and such information will consequently become valueless.

One of the disabilities under which shipbuilders labour at the opening of the century is a scarcity of skilled workers, and particularly of riveters. We note that in the current number of the Boilermakers' and Iron-shipbuilders' Report, not only private firms, but also a Government department are making applications for men of the last-named class, and it is very much a matter of doubt whether the society officials will be able to supply them. During the whole of last year the insufficiency of hands was a source of constant hindrance and loss to shipbuilders; but the drain of men from shipyards and other works, caused by the calling up of the Reserves and the Militia contingents, has greatly accentuated the difficulties of the situation, and it is already quite evident that some drastic measures will have to be taken if the work of our shipyards is to go on without serious interruption this year. If the trade union, which arrogates to itself the right to settle who shall, or who shall not, work at the trade, should confess itself unable to supply the requirements of shipbuilders, then the latter should supply themselves by opening their yards to all eligible candidates for employment.

The two yards belonging to Messrs. Armstrong, Whitworth & Co., at Elswick and Low Walker, are well stocked with work—the former with cruisers, &c., in various stages of progress, and the latter with merchant vessels, some of which are of exceptionally large size. The extensions and improvements which have been in progress for a considerable time are now nearing completion, and a substantial increase in the productive capabilities of the establishment will be provided. At the adjoining yard of Messrs. William Dobson & Co. there are three vessels on the stocks, one of which is in an early stage, whilst the others are well advanced. Messrs. Wood, Skinner & Co. have their berths fully occupied, one of the vessels on the stocks being almost ready for launching.

Messrs. Wigham-Richardson & Co. have some half-dozen vessels in progress on the stocks, besides a number on the water being fitted out or getting repaired. One of the very large vessels building, is understood to be for the North German Lloyd, whilst another—of equal size—is said to be for the Pacific Steam Shipping Co., Limited. Both these vessels are not only of exceptionally large dimensions, but are specially designed for high speed, and will be fitted out in full accordance with modern ideas of effective steamship equipment.

Messrs. Hawthorn, Leslie & Co. launched a large meat ship recently, and have one or two others on the stocks. They have also in progress other merchant steamers of an important class, besides torpedo-destroyers, and are, on the whole, exceedingly busy. The graving dock, which is just now occupied with a vessel undergoing repair, was scarcely ever without an occupant during last year, and must have proved a good source of income to the firm.

Messrs. C. S. Swan & Hunter are said to have received from a firm at Montreal an order for four steamers, to form part of a canal fleet to run between Port Colbourne and Montreal. The vessels will be 245 ft. in length by 80 ft. in width, and will be capable of carrying 80,000 bushels of grain. It is probable that the machinery for these vessels will be constructed on the Tyne also. At Messrs. Stephenson's yard, quietude now exists, but the establishment is in a transition state, and it is probable that before the end of the year a very marked change for the better will have to be noted.

The Palmer Co. are now exceedingly busy in the shipbuilding departments, and are pushing on the work of both merchant-ships and war-ships, with all possible despatch. It is found necessary to keep a night shift going in the frame turning and adjusting departments, and in the repairing section of the works quite an exceptional pressure of activity exists. Not less than half-a-dozen vessels of various descriptions are on the water being fitted out. The Commercial Dry Dock Co. at Jarrow are also having a busy time, both the large graving docks being occupied with vessels under repairs. Last year's business at this establishment was, we understand, of an extremely satisfactory character.

The Tyne Shipbuilding Co. have made their first contribution to the year's output by launching on the 16th inst. the s.s. *Zinnia*, ordered by the owners of the Stag Line, North Shields. The keel for another large vessel has already been placed in the vacated berth, and this promptitude may be taken as an indication that the firm have other orders to follow. The Northumberland Shipbuilding Co.'s yard continues to be well supplied with work, and at Messrs. Readhead's establishment the whole of the four building berths are occupied with vessels of large size in the various stages of plating, framing, keel-laying, &c. There are also vessels being fitted out in the water, and the repairing department is exceptionally busy. The smaller yards at Shields are as busy as could be desired, and most of the graving dock proprietors are having as much work as they can deal with.

Engineering.—Almost the first vessel fitted with engines this year by the North-Eastern Engineering Co., Wallsend, was the s.s. *Dordrecht*, which was built in Holland, to the order of a Rotterdam firm. We presume it is not the first time that a foreign-built vessel has been supplied with English engines; but the circumstance is sufficiently rare to be noticeable. It is understood that the company have the contract to fit the machinery of a sister ship, to be built also in Holland, and which is expected to be ready for the engines in two or three months from now.

The Wallsend Slipway and Engineering Co. are understood to have booked some additional orders lately, and night shift is now general throughout the works. At the St. Peter's Engine Works business is exceedingly brisk, and the same may be said respecting the principal departments of the Neptune Works, Low Walker. The Elswick Ordnance Works are, if anything, busier than before the advent of the new year, and the Forth Banks Engineering Works, Newcastle, are understood to be greatly pressed with orders.

In the manufacture of ship and engine forgings, great activity now exists, and prices are tending upwards. Cast steel stern frames and rudders, which at one time were much sought after, are now less extensively used, the preference of owners being apparently for the forged articles. In the ironfoundries business is good, and brass foundries continue to be well employed.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—During the month of January there have been no vessels launched on the Wear; but nevertheless a good deal of work has been done, many vessels having been advanced almost to the point of completion, and the result will doubtless be seen by the number of launches which are likely to take place in February. It has not transpired that any new orders have been booked this year; but it is well known that enquiries are numerous, and, if no negotiations have been brought to a successful issue, it is doubtless because builders find themselves unable to make concessions. One of these sectional strikes which, during the past few years, have been the source of so much inconvenience to shipbuilders, has caused a partial stoppage at Sir James Laing's yard during the first two weeks of the year. We refer to a strike of the platers' helpers for an extra man in each squad, when the plating of a vessel was commenced toward the end of December. It will be seen from this that there are more things than wages and hours, about which disputes may be made, and the relations of employers and employed embittered. These helpers appear to be blind to the fact that when striking for "more help," they are aiming at a thing which is of greater advantage to the platers than to themselves. Such is the state of affairs, however; for, whenever additional help is obtained, it is the employer and not the plater who has to pay for it. More help, of course, means more work (or ought to mean it), and the plater being paid by results, is the real gainer. If it could only be made plain to the helpers—how much they lose and how much the platers gain—by these ridiculous strikes for "help," they would soon get rid of their predilection for this particular form of folly.

There is a fair amount of repair work in the port just now, most of the shipbuilding firms having repair contracts in hand, and it is understood that negotiations for the acquisition of other contracts are under way.

Engineering.—The s.s. *Silvertown*, owned by the Eastern Telegraph Co., has arrived at the works of Messrs. George Clark, Limited, to undergo a thorough overhaul of her machinery and boilers. That the contract is rather an extensive one will be seen from the circumstance that new cylinders will be fitted, and the boilers will be provided with new furnaces. A large amount of other work will have to be carried out in connection with the vessel's machinery before she leaves the hands of the engineers to resume the important service of laying submarine cables. The resources of the Southwick Engine Works, however, are large; and it is expected that the repairs will be completed by the end of April. The *Silvertown* was built in 1873 at a well-known Tyneside dockyard, and was at the date of launching one of the very largest vessels afloat. She was originally named the *Hooper*, and occupied exactly 100 days in the building. Considering the vessel's size, which is 338 ft. in length by 54 ft. beam, this was a rare achievement at the time, and notwithstanding the numerous labour-saving and time-saving appliances that have since been introduced in shipbuilding, it is very much to be doubted whether—in the majority of yards—the feat could be accomplished at the present day. The vessel's interior fittings are of a much more elaborate character than is customary in merchant ships that are not intended for the accommodation of passengers, the manufacture of the huge tanks for containing the cable involving in itself a vast amount of labour. It should be stated that the vessel was originally engined by a firm which has now ceased to exist—Messrs. T. Clark & Co., of Elswick.

At the Palmer's Hill Works business is still brisk, and the same may be said in reference to the North-Eastern Works, South Docks, Messrs. Doxford's, and Messrs. Allan's. The smaller engine works generally are kept steadily going, and in the foundries orders are plentiful.

At the Sunderland Forge and Electrical Works trade still continues good, the latter department having some important contracts in progress, and the former being so full of work as to necessitate the running of the machinery night and day. The other forges are kept fairly busy, and anchor manufacturers are having plenty to do.

It is understood that the great work of dock extension contemplated by the Wear Commissioners, and which is estimated to cost £150,000, is to be commenced almost immediately, the fact that at other northern ports extensions are announced having doubtless had its effect in stimulating the Commissioners to brisk action. There is not likely to be much difficulty about the labour supply, as the class of workers who will be at first required appear to be plentiful enough.

The Hartlepools.—Shipbuilding work at this centre is still very active, and there have already been one or two launches this year. At all the yards vessels are in advanced stages, and a good many will be put off the stocks during the next month. In the engineering and boiler works orders are abundant, but a scarcity of labour is seriously impeding operations in the latter departments. The Hartlepool Steel Works are kept going night and day, and at the docks coal shipping is moderately brisk.

Stockton.—Messrs. Ropner & Sons have introduced another design of trunk steamers, which, however, does not appear to possess much claim to originality, combining, as it appears to do, some of the more salient features of Doxford's "turret" and Priestman's "sloping deck." After all, the "turret" design seems to be the only innovation which has achieved an extended popularity; for no other has been taken up by the more important shipping companies, and no other has so many representatives afloat. All the imitators of the "turret" design would doubtless have followed it very closely were it not for a wholesome dread of the consequences of infringement. They have accordingly been obliged to adopt modifications, but these have not met with the approval accorded to the original, and are, in fact, little to be distinguished from failures. The conclusion to which this leads is that, in spite of the apparent ineffectiveness of the patent law to protect inventors, the "turret" design, which was the first departure from the ordinary routine of ship construction, continues to hold its own. At Messrs. Blair & Co.'s engine works sustained activity is the feature, and at other engineering establishments there is a fair amount of work in progress. Steel works have again got into full swing after a somewhat prolonged holiday at the new year, and in the forges, foundries, and shops considerable activity continues to be apparent.

Middlesbrough.—The shipbuilding establishments are fully supplied with work, both in the new and repairing lines, and at all the engine works briskness is well sustained. Steel works are kept actively going, and both bridge and boiler works are busy. In the docks there is not much doing, the timber import trade being now at its dullest period.

Consett.—The Consett Iron Co. have a great amount of work in hand, and a large weekly output is maintained.

THE MERSEY.

(From our own Correspondent.)

THE position as regards the marine and general engineering industries of this district remains much as last reported. In practically all the leading branches establishments continue exceedingly well engaged, with full employment ensured for some time to come. Amongst machine-tool makers there is some slackening off in new orders coming forward, which in some cases are not sufficient to replace contracts that are being completed, but the prevailing opinion is that a good deal of new work is just now simply being held back. Other sections, such as locomotive and stationary engine building and boiler-making continue very actively engaged, and in all departments of electrical engineering there is no falling off in the exceptional pressure reported for some time back.

The usual monthly returns of the engineering trade unions still show a very low unemployed list. The Amalgamated Society of Engineers reports an increase of out-of-work members as compared with last month, but this is due almost entirely to holiday suspensions, which are a usual occurrence at the commencement of the year, and is not due to any decline in trade. The proportion is now about 2·6 per cent. throughout the organisation, and a little over 2 per cent. in this district. The Steam Engine Makers' Society has now only ½ per cent. of the total membership on donation, and practically none locally; with a demand for men, especially from the Government dockyards, which the officials are unable to supply. In the United Machine Workers' Association there are less than 2 per cent. on benefit, both locally and throughout the country. Returns from branches as to the state of trade continue of a very favourable character.

Messrs. Laird Brothers have received the order for the propelling machinery for the battleship *Montague*, now building at Devonport Dockyard .The engines are to develop 18,000 I.H.P., or 3,000 in excess of those of other ships of the *Bulwark* type. The difference will give the *Montague* a knot more speed.

Mr. Henry Hodgson, president of the Manchester Association of Engineers, in his inaugural address on January 13th, dealt with the question of foreign competition in the mechanical industries. There was, he said, one branch of engineering in which up to the present competition had not invaded our shores. He alluded to shipbuilding and marine engine building, but even in this branch of engineering our two competitors (America and Germany) were now in a position to supply almost without exception their own requirements, and, especially the latter, were supplying some other countries with a large portion of their requirements in this line. He ascribed this more particularly to political influences than to economical causes. Our supremacy in this, which we might term our national branch of engineering, was, however, being successfully assailed, and we would have to take greater heed to our ships than we had done recently if we were to maintain our supremacy. We had allowed Germany to make herself the possessor of the blue ribbon in the races across the Atlantic; we had also allowed her for a time the honour of having built the largest steamer the world had yet seen, and he did not think it would be long before she again took the position.

The Klein Engineering Co., Limited, of Manchester, are supplying to Messrs. Vickers, Sons & Maxim, Limited, of Barrow-in-Furness, a central condensing plant of their special type. In connection with this plant a Klein patent chimney cooler will be used, whereby a continuous supply of condensing water is obtained, the water being cooled by falling over a stack of cooling frames in the base of the chimney, a current of air being produced by the difference in temperature between the air in the chimney and the outside atmosphere. Only a small quantity of water is required for condensing to make up the loss by evaporation, which does not at any time exceed the weight of steam condensed, so that less water is required when working condensing than when working non-condensing. The jet-condenser is on the counter-current principle, which is now generally recognised as the most effective and suitable type for condensing large quantities of steam with a central plant, which in this case is designed to deal with the exhaust steam from engines of 1,500 H.P. A similar plant is being erected to the order of the Liverpool Corporation for their new Lister Drive Power Station to deal with the exhaust from engines of 3,600 H.P.

During the earlier part of the month the iron market here, as far as raw material was concerned, was somewhat unsettled, owing largely to the fall in warrants, and there was a good deal of underquoting by merchants, with very little business being put through; but towards the close a stronger tone has come over the market, and prices show again a hardening tendency, with an increased enquiry coming forward. Local makers have stiffened up to 80s. 6d. less 2½ for No. 3 foundry, with Lincolnshire firm at 75s. 6d. to 76s. net, and Derbyshire foundry 80s. net. delivered Manchester; with forge qualities 76s. to 76s. 6d., less 2½, for Lancashire, and 74s. 2d. to 74s. 8d. net for Lincolnshire delivered Warrington. Middlesbrough and Scotch brands, which at the commencement of the year were being offered by merchants at considerably under makers' prices, are now much steadier, the general quotations being 78s. 4d. to 79s. 4d. net for Middlesbrough by rail Manchester, and 81s. 6d. to 83s. for Eglinton and Glengarnock delivered Manchester Docks; whilst American pig-iron, which is now offering more freely, has been sold at 78s. net Manchester Docks.

In the finished-iron trade there has been a further substantial advance in prices, and, although in some directions this has tended to check buying, makers are so fully booked that they can afford to be indifferent about further orders just at present. Lancashire bars have been put up 10s. per ton, the list rate being now £10, with makers asking 5s. more on any small lots they can offer for prompt delivery. North Staffordshire bars remain nominally at £10, but makers would not take under £10 5s., and an official advance even beyond this latter figure is probable before very long. Sheets are now quoted £11 to £11 5s. Hoops have been raised 10s. per ton, bringing list rates to £10 7s. 6d. for random to £10 12s. 6d. for special cut lengths, delivered Manchester district, and 2s. 6d. less for shipment. The Manchester iron merchants have put up their stock prices 10s. per ton.

A fairly active business is reported in the steel trade, with prices tending to stiffen up. Hematites have fluctated considerably during the month in the open market, but are now recovering somewhat, and makers are quoting 91s. to 93s., less 2½, delivered Manchester. Local bars have in some cases been advanced 10s., but general quotations still range from £9 to £9 15s., whilst boiler plates are scarcely now quoted under £9 15s., and hoops have risen 10s. per ton, £10 10s. being the new basis, delivered in this district.

The metal market maintains a steady tone as regards prices, and the demand is brisk, particularly for locomotive and boiler fittings. Delivered Manchester district list rates remain as under: solid-drawn brass boiler tubes 9d.; condenser tubes 10½d.; copper tubes 11½d.; brazed copper gas and steam tube 11¼d.; brazed brass tubes 10d.; common rolled brass 8¾d.; common brass wire 8½d.; copper wire 8½d. per lb.

Particulars that have come to hand respecting the tonnage employed in the timber trade to Liverpool, including Garston and the Manchester Ship Canal, show a total of 776,984 during the past year, as against 715,636 in 1898 and 765,342 in 1897. Business during the year was, as the above figures show, again very large, and it was generally of a sound and satisfactory nature. With the advantage of fairly moderate stocks at the opening of the season, early arrivals found a ready sale; and, notwithstanding the large import later on, the exceptionally active demand more than kept pace with this, leaving stocks at the close generally lighter than usual. Values opened steady, and for most articles continued to advance to the end of the season, owing partly to advanced freights, but more particularly to the higher f.o.b. rates. Freights, with the exception of some low charters effected early, continued firm, and steadily rose throughout the year. The heavy premiums now ruling for late shipments call for shippers' special attention. Of the total import of timber the Manchester Ship Canal claims a large percentage, some 350,000 loads—being a heavy increase on any previous year. In commenting on this fact a Liverpool firm of timber brokers state that it is largely due to the insufficient accommodation provided for this trade in Liverpool by the Mersey Docks and Harbour Board, and has been further aggravated during the year by a number of their tenants at the Canada Dock having been served with six months' notice to quit, thus still further reducing the already too limited area for conducting the business. "Notwithstanding" they proceed, "the repeated and strong representations made to the Board by the Timber Trade Association to provide storage accommodation, as well as discharging berths to replace that which has already been and which is now to be taken from them, they have hitherto turned a deaf ear to their representations, and refused to make any adequate provision for the preservation of this trade to the port of Liverpool; therefore it would appear that a large portion of what is still left to Liverpool will have to be transferred to Manchester, Fleetwood, and Preston." The arrivals of teak during the year were 348,000 cubic feet, as against 319,000 the previous year. For squares the demand was rather quiet, but there was still a fair consumption, and the stock is not now too heavy, with prices steady. Planks, scantlings cut to specifications, &c., were in more active request. There was a large import, but with the consumption good, prices were well maintained. There is, however, a fair stock in hand. The consumption of greenheart was smaller than in 1898, but kept up with the import. Logs of large sizes and piling timber fully maintained their values. For medium-sized logs there was not much enquiry. Prices during the summer showed some weakness, but recovered later on. Stocks at present are moderate.

In the coal trade the pressure of demand, particularly for all descriptions of fuel, suitable for iron making, steam and general manufacturing purposes, and the difficulty experienced by collieries in meeting the requirements of customers, combined with the further upward move in miners' wages, have led to another advance in selling prices, which in the Manchester district represents about 10d. per ton, and in the south-west Lancashire district, of which Wigan is the centre, 1s. 3d. to 1s. 8d. per ton. The pit prices are now about 14s. 6d. to 15s. for best Wigan Arley; 13s. to 13s. 6d. for common Arley and Pemberton four-foot; 12s. to 12s. 6d. common house coal, with pit prices in the Manchester district for corresponding qualities about 5d. to 10d. more. Steam and forge coals are about 12s. to 12s. 6d., and engine fuel 9s. 6d. to 10s. for medium, and 10s. 6d. to 11s. for best sorts, at the pit.

Shipping prices are even higher than inland quotations, and 16s. is the general figure that has been readily got for ordinary steam coal delivered Mersey ports.

In the coke trade also an upward move is taking place.

LIVERPOOL AND BIRKENHEAD NOTES.

(*From our own Correspondent.*)

THE first month of 1900 has been a good one to the principal companies engaged in shipbuilding and engineering on the Liverpool and Birkenhead sides of the Mersey. Last year left orders enough in hand to give the new year a fair start, and to create a firm belief that trade, during the early part of 1900, would be as good as it was during the closing months of 1899. Apart from new work, the continued taking of steamers for transports by the Government has made a lot of work for local yards and fitters, and as the steamers have all been wanted at short notice, the work of adapting and overhauling has gone on briskly night and day. As regards the adaptation, this has chiefly required woodwork, and has meant the putting up of partitions and berths for the accommodation of troops, and for the safe housing of the horses, being sent to the Cape. The overhauling of the machinery to insure that all working parts were in fit condition for a quick run to the Cape, has however, been a big and important job, and has kept fitters and iron workers very busy. Everything has had to be overhauled; main engines, pumps, electric-lighting plant, steering gear and telegraphs. The overhauling of bridge and engine-room telegraphs, has made the principal firms manufacturing these appliances busy, whilst the work at the heavier engines has kept a strong body of fitters going continually for nearly four months past. Messrs. Laird Brothers have had a good deal of this transport outfitting, and Messrs. Clover, Clayton & Co. and the Messrs. Grayson have also had a fair run of it. Now that the larger steamers are being chartered for transport service, less of the work of overhauling machinery is likely to fall into the hands of private companies and firms, as front-rank steamship companies—like the Cunard, White Star, Allan and Elder Dempster companies—have well equipped engine works of their own, or have such arrangements operative as amply suffice to meet any ordinary demands on overhaul or replacement account. The chance of the private firms coming in for a further share of the work will lie in the quick despatch which the Government require. Though the first-class boats of the Atlantic and Cape service have been in good trim when chartered, the working parts of all of them have been seen to before a single valve has been moved on the outward journey. The Government were a long time in coming to the conclusion that the best boats were what they wanted for the South African transport work; but having made up their minds upon this they have not been slow to call for the boats. Among the latest to be requisitioned were the Johnstone Line steamer *Ulstermore*, the Elder Dempster steamers *Lake Erie*—the new steamer intended for the Canadian Mail service—the *Milwaukee*, the *Monteagle*, and the *Mount Royal;* the White Star liner *Afric*, the Dominion liner *Norseman* and the Lamport & Holt liner *Cavour.* A list prepared by the Liverpool Underwriters' Association gave the names of 161 vessels, including re-charters, which had been requisitioned by the Government for transport work up to about January 23rd. The *City of Rome* left Liverpool with troops on January 17th, and the fine new *Winifredian* of the Leyland Line is now chartered. All of this means good business for fitters and electric light people. There will not be much slack time in the Mersey fitting shops for the next three months.

As regards new work, the year opened with a considerable amount of new work in hand, in the Liverpool and Birkenhead engine and boiler shops. At Messrs. Laird Bros. the building of the first-class battleship *Exmouth* had reached an advanced stage at the close of the year, the frame being up to the protecting deck. Two single-screw sloops the *Mutine* and the *Rinaldo* of 980 tons displacement, and 1,400 H.P., were also nearing the launching stage and two thirty-knot destroyers, for the British Government were being proceeded with. This new work has been forwarded considerably during the month. The acceptance of Messrs. Laird Bros'. tender for supplying the engines for the first-class battleship *Montague*, has brought another desirable order to this Birkenhead firm. Two sets of triple-expansion engines to develop 18,000 I.H.P. are required under this order. Steam will be supplied by means of 30 Belleville water-tube boilers which Messrs. Laird Bros. will also manufacture, The cost of engines and boilers will be £150,000.

Much interest has been aroused in the Mersey engineering and shipping trades by the announcement that Messrs. Laird Bros. have obtained, from the Liverpool Corporation, a new 75 years' lease of the site on which their works in Church-street, Birkenhead, stand. Under the new lease, the firm will also acquire the site occupied for some years past by the Royal Mersey Yacht Club, which will give them room for the construction of two or three more launching ways, or for a re-arrangement of their existing "ways" in order to obtain more dry dock accommodation. It has been well known in the district that Messrs. Laird Bros. have at times been prevented from taking work owing to their single dry dock being occupied. An extension of their works is therefore now regarded as certain. The acceptance of the new lease is viewed in the light of a municipal boon at Birkenhead, for rumours had lately got abroad that Messrs. Laird Bros. were contemplating a removal to some other port. This, happily for Birkenhead, is not to be.

The steady output of new tonnage has made a good deal of work for the makers of side-lights and ventilators, and some large orders for these adjuncts have come to Liverpool. Messrs. T. Utley & Co., whose works are at Tue Brook, Liverpool, have been particulary busy making side-lights and ventilators of some half-dozen patented types. Last year this company made a heavy delivery of high-grade side-lights for the Queen's new yacht. About the same time their works at Tue Brook were extended to give more room for working.

Two recent changes in the Liverpool marine engineering trade deserve passing notice. The Liverpool Engineering and Condenser Co., Limited, who worked up an excellent business in Brasenose Road, at the north end of the city; recently erected a new and well planned block of works in Perry Street, at the south end. The entire plant and business has been transferred to what are now, the Perry Street Engine Works. Here, with more room, and with machines arranged to best advantage, a brisk trade is being done in the ship's condensers which are the company's speciality.

Messrs. C. & A. Musker, Limited, the well-known makers of hydraulic cranes, lifts, high-speed engines, electric motors, and dynamos, have just removed from their old works, Dundas Street, Bootle; to more extensive works at Tue Brook. This company have been very busy for months past. There has been a large demand in the district for hydraulic passenger and goods lifts, and for electric motors. These last seem to be coming into use for every kind of light driving, where speed is required. Work of the class has been plentiful in Liverpool, and 1900 has opened full of promise to the makers of such machinery.

The engineering department of the Mersey Docks and Harbour Board has done much important work of late. In 1898 Parliamentary powers were sought by the Board for an expenditure of £3,561,204 upon new works on the dock estate at Liverpool. The works contemplated by the Board have been rapidly pushed on during the past year. Though very largely of the nature of constructive works—the making, widening, deepening, or altering of docks—work of a marine, mechanical engineering nature, entered largely into the details of the scheme. Four swing bridges with hydraulic appliances, for example, were specified for in the estimates, whilst, during the actual work of construction, engines, pumps, and mechanical aids, almost innumerable, have been brought into requisition. The ordinary work of the engineering department of the Mersey Docks and Harbour Board is on a most extensive and varied scale. The Board's accounts for the year ending July 1st, 1899, showed that the year's outlay on general repairs, maintenance, and improvements, carried out by the department at Liverpool and Birkenhead, had been £251,580 19s. 8d. This total included such substantial single items as:—"Providing additional engine power at hydraulic power centre, Toxteth Dock, including accumulator at Harrington Dock, £3,480 10s. 6d."; "Additional hydraulic central power, Waterloo Dock and northwards, £25,283 17s. 8d."; "Hydraulic power, &c., £24,431 19s. 3d." At a recent meeting of the Board a recommendation of the Works Committee that the Board provide accommodation for the repair of pontoons by the engineering department at the Canada Works, Birkenhead, at an estimated cost of £1,600, was approved of without question.

The Liverpool Salvage Association are another enterprising body who are continually on the watch for new methods or appliances which may enable the work of marine salvage to be done more efficiently or expeditiously. On January 16th, Mr. Page, superintendent engineer of the association, with Captains Young and Pomeroy, witnessed a series of trials of new diving apparatus, from the salvage steamer *Ranger*, at the South Carriers' Dock, Liverpool. The main feature of the new diving gear is the introduction of means of telephonic communication between the diver and a steamer's deck. The trials passed off satisfactorily, the diver stating that he was able to hear the communications from the deck, whilst he was under water, distinctly. Submarine telephony promises to play an important part in the difficult work of diving.

Marine boiler makers at Liverpool and Birkenhead have had a good run of trade, and began the year with orders which will carry them on for some time. Steam winches have been in steady demand. Apart from the requirements for new ships, the desire of builders and owners has been to provide all kinds of craft with handy steam winches, as these appliances are now assessed at their true value, and give an independence to a vessel unknown in the old capstan and windlass days. Messrs. Dunlop, Bell & Co. keep very busy on winch work.

About 150 members and guests of the Liverpool Engineering Society assembled at the Adelphi Hotel, Liverpool, on the evening of January 11th, on the occasion of the annual dinner of the society. Mr. J. Bromley Holmes, president of the society, presided, and was influentially supported, the Lord Mayor of Liverpool and the American Consul being amongst the guests. Responding to the toast of "The Engineering Profession and the Liverpool Engineering Society," which had been proposed by the American Consul and supported by Dr. Tudsbery, secretary of the Institution of Civil Engineers, the President congratulated the society that their membership had increased from 51 in 1876 to nearly 500 in 1900. Speaking of the position of British engineering, he said that it was not satisfactory that this country should be losing its position in the markets of the world as a manufacturer of machinery, and that it should have to go either to America or Germany for plant that English engineers ought to be able to make for themselves. They were apt to excuse themselves on the ground that lower wages were paid on the Continent, but they shut their eyes to the fact of the better technical education there provided—statements which were warmly applauded by the Liverpool engineers.

On the evening of January 12th the members of the Birkenhead branches of the Amalgamated Society of Engineers met in the Queen's Hall, Birkenhead, for their annual concert and ball. During the concert Mr. C. Gatehouse presided, and at the interval Mr. F. Rose, organising delegate, addressed the assemblage. Mr. Rose spoke in glowing terms of the progress of the society. Its membership had, he said, increased during the last year by 2,000, and their financial balance which stood at £300,000 at the close of the last year, had increased to the extent of over £93,000. The prospects for the coming year were, he said, full of hope, and he could safely say that the Birkenhead members would not be in the rear ranks in supporting and furthering any movement that aimed at progress. A dance followed this cheering announcement of the position of the society, and the hours sped all too swiftly for the merry-making members of the A.S.E.

THAMES.

(From our own Correspondent.)

MR. W. F. STANLEY, of Great Turnstile, High Holborn, is the maker of an excellent inclinometer theodolite. It is capable of doing very rapidly work which can in the ordinary way only be done with a great expenditure of time. On steep ground the ordinary instrument has to be shifted many times, since it is necessary to pump down from the ends of the chain. With the new theodolite the work is done as easily as on level ground. When the instrument has been levelled the telescope can be set to any angle. When this has been done, the staff is placed at any point cut perpendicular to the line of sight. The distance is then taken along the slope, and the angle which the line of sight makes with the horizontal is observed. To effect this the telescope is mounted on a supplemental axis at right angles to the ordinary transverse axis

Diesel Oil Engine.—The excellent results obtained from the trials of this oil engine should be of considerable interest to other makers of marine oil engines. Herr Diesel, the inventor, considers that steam, gas, and air engines, are worked on a defective principle. His own engine he bases on an entirely new theory. In the steam engine he sets down the loss in the boiler at from 20 to 30 per cent. He raises the objections of small theoretical efficiency, sensitiveness of steam to changes of temperature and tendency to condense on the walls of cylinders. He thinks a greater range of temperature in the cylinder is desirable, and he thinks, since the temperature is limited downwards, it must be raised in the other direction by increasing the pressure or by combustion in the cylinder itself. Gas and oil engines have been designed on those lines. Diesel, however, regulates the combustion of the stuff in his engines. He sets the heat losses down in the ordinary gas and oil engines at between 75 to 80 per cent. He tried first to reduce the losses by isothermal combustion instead of by combustion at constant volume. He did this by introducing a small quantity of combustible into a volume of compressed and highly-heated air, when it kindles spontaneously, and the piston moves out in such a way that no increase of temperature takes place, the heat developed being absorbed in expanding the gas. His fundamental conditions of working were:—1. Production of the highest temperature of the cycle, not by and during combustion, but before and independently of it entirely, by mechanical compression of the air. 2. Gradual introduction of a small and carefully regulated quantity of finely divided combustible into the highly compressed and heated air in such a way that no increase of temperature takes place during the motor stroke, but all the heat generated is at once carried off by the expansion of the gases of combustion 3. Introduction of a large quantity of air in excess, instead of admitting only as much air as is required to obtain proper combustion of the fuel in cylinder. Adinbatic compression of from 30 to 50 atmospheres was adopted. About 100 per cent. excess of air is used, so as to absorb all the heat in the oil. Diesel found it very difficult to get high pressures in his compression. There were three cylinders. The central piston compressed the air, and sent it on to the side piston to be further compressed. Fuel was then injected into the tops of the working cylinders combustion, and partial expansion took place during the down stroke, and then passed to the large cylinder, where it compounded completely and discharged to the atmosphere. The three cranks were 180° apart. For small powers only one cylinder is used. Diesel claims a theoretical heat efficiency of 50 per cent. for his single cylinder engine, and 70 per cent. for the compound type. The brake efficiency is 26 per cent. With a 20 H.P. engine trials were made at full and half power. Piston diameter was 9·8 in., stroke 15·7 in., air pump 2·7 in., stroke 7·8 inch. The tests were as follows:—

Number of Test.	Full Power.		Half Power.	
	I.	II.	III.	IV.
Revolutions	171·8	154·2	154	158
Metric I.H.P.	27·85	24·71	17·71	17·72
,, B.H.P.	19·87	17·82	9·58	9·84
Oil per I.H.P. per hour	·4	·39	·61	·61
Temperature of exhaust gases ..	404	378	260	260
Piston Speed	450	400	400	410

HEAT BALANCE SHEET.

	I.	II.
Percentage of heat in oil turned into I.H.P.	33·7	34·7
Percentage of heat in oil lost to cooling jacket water	39	40·3
Percentage of heat in oil lost in other ways	27·3	25

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—The shipbuilding industry in this district remains in a very active state, and the work which is proceeding is not only considerable, but is being pushed forward with all the energy which builders can command, and all the men that can be obtained are being employed in every department. There is, however, the old difficulty of housing the very largely increased number of men who are now required to do the work in local shipbuilding yards; and, although a large number of houses are being built in various parts of Barrow, the accommodation is still fully a thousand below the requirements of the town at present, and probably still another thousand houses below the requirements of the town in the immediate future. Indeed, there is a growth in the demand which is in greater ratio than the present rate at which new house property is being built, for one thing is certain, that since Messrs. Vickers, Sons & Maxim took over the Naval Construction Works here, there has been an expansion of enterprise in other industrial directions, showing that as soon as this great firm displayed its confidence in the future of Barrow other firms were prepared to come in and share the results of what has already been proved to be a great industrial development. But this great enterprise is causing the great demand for houses in the town to be even greater, and whilst this is all very well in its way, it is certainly tending to check large schemes which have been formed, and which it is well should be proceeded with when times are brisk and trade plentiful. Even the war with the Transvaal is indirectly helping the trade of Barrow not only in a shipbuilding sense, but in a general sense as well. The newest department at Messrs. Vickers's works is the one set apart for gun-mounting It has already outgrown its original dimensions, and is now twice the size originally contemplated, but it has been determined to double it again, and thus make it four times the size it was originally intended to be. This department is now very congested with work, and orders are still coming in; indeed, an order was given out the other day by the Government to Messrs. Vickers to make certain types of guns, and as many as them as possible until the order to stop is given. This is something like an order, and it is certainly one which would have been all the more welcome if local makers had been as well fitted up for the work as they hope to be in the course of a year or two, when their present plans have been thoroughly matured. In the meantime, it is interesting to know that the newest branch of Barrow's industry is the most active, and that it has before it a very much longer spell of briskness than any other of Barrow's industries, and that is, of course, saying a great deal, when it is remembered that shipbuilders have about three years' work in hand, and that the iron and steel trades are more actively employed than they have been for years, and that they have an outlook before them which has not been exceeded for brightness and hopefulness at any time in the industrial history of this district.

No new orders have been accepted by Barrow builders during the month, as they are so very fully employed in every department of their business, but it is highly probable that before the close of the present year their orders now in hand will be so far advanced that it will be practically possible to give attention to the initial stages of new work which is destined in the ordinary course of things to take the place of that which at present is engaging the attention of builders. There is one thing certain, that when builders are ready for orders, orders are ready for them. There is not at the moment a big demand for commercial tonnage, but there are indications that as soon as this war is over there will be a revival in shipbuilding at any rate in two, if not in three, directions. In the first place it is clear a larger and faster fleet of steamers will be put on the Cape service, and if the present lines are not equal to the demand, and are not able to meet the emergency, well, new lines will start and take the matter up; indeed, there is already some talk about this, although it is not in any sense identified with Barrow builders, at any rate, up to the present time. There is also the prospect of further enterprise in connection with the Atlantic trade. British owners are not disposed to allow all the honours for speed and size of ships to go to Germany and America, and there is sufficient enterprise amongst British owners to put in hand a comprehensive and ambitious programme which will, at any rate for the time, put British precedence beyond the shadow of doubt. There is the further prospect of a fuller development of steam navigation between this country and India, besides a large growth in the ordinary cargo steamers employed in the foreign trade under the British flag.

Much progress has been made at the Naval Construction Works at Barrow during the past month with the work in hand, and, as a far larger number of men are employed and the work is distributed over so many ships, progress is being simultaneously made with a very large programme of work. The most forward ship in progress is H.M. first-class cruiser *Hogue*, which is armoured, and of the same class as the *Sutlej*, *Cressy*, and *Aboukir*. She is making very rapid progress towards completion; it is not, however, likely she will be launched before next autumn, in consequence of the works now in hand at the docks at Barrow. As has already been stated in the MARINE ENGINEER, this deepening scheme is intended to give an entrance into all the docks at Barrow 6 ft. deeper than at present. Now the floating depth over the Ramsden Dock lock-sill is only 24 ft., but when this deepening scheme is completed the depth will be increased to 30 ft. The work has already commenced, and it will probably be August or September before it is completed. By that time the *Hogue* will be ready for launching, if not before, but she cannot be docked until this deepening of the dock sill has been completed, nor can H.M. battleship *Vengeance*, now being fitted with her engines and boilers, &c., be able to leave the docks until this deepened way has been provided. The *Vengeance*, however, will be ready to hand over to the Admiralty by the autumn, so that the dock authorities have two reasons for pushing forward this work; indeed, there are two other cruisers building for the Admiralty at Barrow which will also require this deep-water accommodation, as well as the Japanese battleship *Mikasa*, which is rearing up her gigantic sides, and which, with the *Euryalus* and the *King Alfred*, will be ready for launching soon after the *Hogue*. The engineering department of Messrs. Vickers's works is very busily employed, and is indeed thronged with orders. There is a marked growth of facilities for the speedy and excellent production of all classes of goods required in the engineering department, and new shops are springing up on every hand which are destined to make the firm more dependent on its own sources of production.

West Cumberland.—The shipbuilding trade in West Cumberland is very busy both at Workington and at Maryport, and it is evident from the activity shown at the shipbuilding yards at both these places that the briskness observable all over the country in the heavier class of tonnage under construction is also evidenced in yards where the smaller craft are built. Orders are quite as plentiful as builders are able to deal with them, and it is satisfactory to learn that as work progresses at both Workington and Maryport there is plenty of new business ready when builders are in a position to undertake it.

Shipbuilding Material.—There is a very brisk demand for all classes of shipbuilding material, and, although orders have not recently been booked for new ships, it is evident builders find their requirements still very large, and are preparing probably for other work which is in embryo at present, but which will doubtless engage their attention when the present heavy strain of Admiralty work has been disposed of. Heavy plates are in very full request, and are quoted firmly at £8 per ton, whilst light plates are in equally full demand and are quoted at £9 per ton. Makers are very fully sold forward in all departments, and keeping their mills in very regular and constant work. The demand for heavy steel castings is maintained. There is now a very large trade doing in nuts and bolts at Barrow, and a large crucible steel plant is being put down for the manufacture of special steel for use in shipbuilding, engineering, and other work. A very large steel casting plant is also being put down, together with a large brass and bronze foundry, and other departments which will help to concentrate in Barrow every possible branch connected with the shipbuilding and engineering trades.

The Hematite Trade.—A very brisk business is being done in the hematite pig-iron trade, and the demand still exceeds the production. Prices are therefore very firm for makers' iron at 80s. per ton, and for warrant iron at 76s. 4d. net cash sellers, with every prospect of a considerable improvement in prices during the year. There are 47 furnaces in blast as compared with 40 at the corresponding period of last year. Stocks have been reduced from the beginning of the year to a considerable extent, and now represent 192.530 tons,

Shipping.—There is very great activity in the shipping trade of this district. Since the beginning of the year 46,736 tons of pig iron have been shipped from West Coast ports, and 16,648 tons of steel, showing, as compared with the corresponding period of last year, an increase of 27,736 tons of pig iron and a decrease of 5,604 tons of steel. Shipping generally is well employed, and good prices are obtained for freights.

Oro.—On January 19th the fine steel screw steamer *Oro*, built by Sir Raylton Dixon & Co., Limited, Cleveland Dockyards, Middlesbrough, to the order of Messrs. Gellatly, Hankey & Co., London, for the Plate Steamship Co., Limited (of which we gave particulars in our November issue, page 370), was taken out to sea for her official trials under the command of Captain Fowler,

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Indradevi. — On December 14th there was launched at Sunderland, for Mr. T. B. Royden, of Liverpool, a steel schooner-rigged steamer of about 5,423 tons gross, named the *Indradevi.*

Atlas.—On December 18th there was launched at South Shields, for Messrs. Bensaube & Co., a steel steam ketch, of about 323 tons gross, named the *Atlas.*

Lockwood.—On December 21st Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a steel screw steamer of the following dimensions, viz.:—299 ft. by 43 ft. by 21 ft. 3 in. moulded. She is of the single-deck type, built of steel, to Lloyd's highest class, under special survey. The deck erections consist of poop, bridge, and topgallant forecastle, large deckhouse being placed on bridge for accommodation of captain and officers. She has water ballast in double bottom fore and aft, and in peak. She is fitted with four double-powered steam winches, patent direct steam windlass, patent steam-steering gear, large donkey boiler, screw gear aft, telescopic masts, and all the latest improvements. The machinery has been constructed by the North-Eastern Marine Engineering Co., Limited, Sunderland, the cylinders being 21 in., 35 in., 57 in., by 39 in. stroke, two large steel boilers working at 160 lbs. pressure. The owners of the vessel are Messrs. Constantine, Pickering & Co., of Middlesbrough, and, as she left the ways, she was gracefully christened the *Lockwood*, by Miss Ella Pickering, daughter of one of the owners.

Nina. — On December 28th there was launched at Low Walker-on-Tyne, by Messrs. William Dobson & Co., a steel screw steamer, which they have built to the order of Messrs. Fenwick, Stobart & Co., London. The vessel is built to Lloyd's highest class, and is of the following dimensions:—Length, 220 ft.; breadth, 35 ft.; depth, moulded, 16 ft. 5 in.; and has been specially constructed for the owners' coasting trade between London and Goole. The machinery is being constructed by the North-Eastern Marine Engineering Co., Wallsend, and consists of a set of triple-expansion engines having cylinders 18½ in., 30 in., and 49 in. by 33 in. stroke, steam being supplied by one large single-ended boiler, working at 160 lbs. pressure. Before leaving the ways the vessel was christened *Nina* by Miss Winifred Squance, daughter of the marine superintendent for Messrs. Fenwick, Stobart & Co.

Chulmleigh.—On December 30th Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions, viz.:—Length over all, 352 ft.; breadth extreme, 48 ft.; depth, moulded, 28 ft. 4 in.; tonnage, gross, about 3,950 tons, with a carrying capacity of about 6,500 tons. This steamer, which has been built to the order of W.J. Tatem, Esq., of Cardiff, will class 100 A1 on Lloyd's Register, and has been built under special survey. She is of the three-deck type, with one deck laid, having poop, long extended bridge, and topgallant forecastle. Accommodation for captain, officers, and engineers is provided in iron houses on bridge deck, crew being berthed in poop aft, and petty officers in topgallant forecastle. A cellular double bottom, and fore and aft peak tanks are fitted for water ballast, and equipment includes six steam winches, large horizontal donkey boiler, steam windlass, stockless anchors, steam steering gear, etc. The engines by Messrs. Blair & Co., Limited, have cylinders 25 in., 42 in. and 68 ins., by 45 in. stroke, steam being supplied by two single-ended boilers, having a working pressure of 180 lbs. As the vessel left the ways she was christened *Chulmleigh* by Miss G. Mence, of London.

Crown Point. — On December 30th there was launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, Limited, North Sands, Sunderland, a fine steel screw steamer, built to the order of Messrs. the Norfolk and North American Steamship Co., Limited, of 1, Crosby Square, London, E.C. The vessel is 390 ft. long between perpendiculars, and has a beam of 51 ft., with a moulded depth of 30 ft. 6 in. She is built on the three-deck rules, with shelter deck extending from the afterside of mainmast to stem, with suitable doors, fittings and ventilators, to meet the requirements of the cattle trade. She is rigged as a two-masted fore-and-aft schooner with telescopic topmasts to meet the requirements of the Manchester Ship Canal. The accommodation for the captain and spare berths is in a large house amidships, and for the officers and engineers, alongside the engine casings. The crew, firemen, and petty officers, and cattlemen are berthed under the poop. The forecastle is also fitted up for the accommodation of cattlemen. The vessel is built to Lloyd's highest class, and is in every way a handsome vessel, built to meet the requirements of the American trade, for which she is intended. She is fitted with 16 derricks, 10 steam winches, and all the most modern machinery for the rapid handling of cargoes. Her deadweight capacity is about 7,500 tons, and provision is made for the carrying of 1,900 tons of water ballast in the cellular double bottom, and a large deep tank fitted immediately aft of the engine-room, and extending to the main deck. The engines are being built by Messrs. J. Dickinson & Sons, Limited, Palmer's Hill Engine Works, Sunderland, and are of the triple-expansion type, the sizes of the cyclinders being 25 in., 43 in., 74 in., by 48 in. stroke, with three single-ended boilers, working at 200 lbs. pressure of steam, and fitted with Howden's forced draught. As the vessel left the ways she was gracefully christened *Crown Point* by Miss Nora Young, daughter of Mr. W. M. Young (London), Messrs. Simpson, Spence & Young, of London and Newcastle, are the managers for Messrs. the Norfolk and North American Steamship Co., Limited, and were represented by Mr. W. M. Young, managing director; Mr. J. G. Hocken (London), director; Mr. Howard Dale, secretary; and Mrs Dale, Miss Norah Young, Miss Florrie Dunford, Miss Taylor, Mr and Mrs. Muir, Mr. James Bain, Captain Ford, Mr. and Mrs. Dunlop (Liverpool), Mr. Kitching (London), Mr. J. Baxter (Newcastle), superintendent engineer to the company. The builders were represented by Mr. Robert Thompson, J.P., managing director, and Mrs. Robert Thompson, Miss May Thompson Master Jack Thompson, and Mrs. J. L. Thompson, Mr. James Marr, director and general manager; Mr. and Mrs. C. E. Thompson, Mr. Joseph Thompson, and Mr. and Mrs. P. Phorson. The engine builders were represented by Mr. and Mrs. F. T. Dickinson, Mr. and Mrs. A. Dickinson, Mr. T. S. Hunter, and others. After the launch, which was most successful, the company adjourned to the firm's luncheon room, where the usual toasts were duly honoured.

Telefon.—On December 30th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Limited, of Bill Quay, Newcastle-on-Tyne, a handsome steel screw steamer which has been built to the order of Mr. P. A. Gron, of Sandefjord, Norway. The vessel is of the following dimensions, viz.:—Length, 255 ft.; breadth, 36 ft.; depth, moulded, 18ft. She is of the long-raised quarter-deck type, with bridge and topgallant forecastle, and is designed to carry about 2,300 tons deadweight on a light draught. Water ballast is provided in the cellular double bottom all fore-and aft, and also in the after-peak. The vessel will be rigged as a fore-and-aft schooner with telescopic topmasts, and when finished will be replete with the latest types of deck machinery and other appliances for economical working and rapid loading and discharging of cargo, as well as all the means for safe navigation. The saloon, captain's accommodation, and spare berths are arranged in a large house on the bridge deck amidships, with chartroom on flying bridge above, the officers' accommodation being in side houses at aft end of bridge deck on either side of the vessel, whilst the crew are berthed in the topgallant forecastle. On leaving the ways the vessel was named *Telefon* by Miss Ida Bodin, daughter of Mr. Lauritz M. Bodin, of Det Norske Veritas, Sunderland. The steamer will have a set of improved triple-expansion engines having cylinders 18½ in., 30 in., and 49 in. diameter, respectively, with a stroke of 33 in., supplied with steam by a large steel multitubular boiler working at a pressure of 160 lbs. per square inch, which have been constructed and will be fitted by the North Eastern Marine Engineering Co., Limited, at their Northumberland Engine Works, Wallsend-on-Tyne. Both the ship and engines have been built under the special survey of Det Norske Veritas for their A1 classification, and have also been superintended on behalf of the owner by Mr. J. Johnsen, of Sandefjord, Norway. When completed the vessel will be commanded by Captain A. D. Christensen, of Skein, Norway.

Adrian.—On January 4th Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions: 110 ft. by 210 ft. 6 in., by 11 ft. by 6 in. depth of hold, built to the order of the Allen Steam Fishing Co., Limited, Grimsby. Engines of triple-expansion type of 58 N.P. are being supplied by Messrs.

Tindall of Hull. The vessel will be replete with all the modern appliances for trawling, the launching ceremony was performed by Miss Allen, of Grimsby, who named the vessel the s.s. *Adrian*, the company then adjourned to the office of the builders for luncheon.

Braeside—On January 4th there was launched from the yard of Messrs. R. Williamson & Son, Workington, a steel steamer classed 100 A1 at Lloyds, for Messrs. T. Pinkney & Son, of Sunderland. The steamer is intended for the general coasting trade, and is of the following dimensions:—Length, 128 ft. between perpendiculars; breadth, 20 ft. 2 in.; depth, moulded, 10 ft. 4 in. Compound surface condensing engines with cylinders 15 ft. and 32 in. diameter by 24-in. stroke will be fitted by Messrs. McKie & Baxter, of Glasgow. The ceremony of naming the vessel *Braeside* was performed by Miss Hine, of Maryport.

Sussex.—On January 16th there was launched at Hebburn-on-Tyne by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, a large four-masted steel screw steamer constructed for the Federal Steamship Co. of London. Her principal dimensions are:—Length over all, 435 ft,; breadth, 54 ft.; depth, 40 ft. to shelter deck. The vessel has been built in excess of the highest class at Lloyd's. The engines of the vessel are of the triple-expansion surface-condensing type, with cylinders of 30 in., 48 in., and 78 in. diameter and 54-in. stroke, with four large single-ended boilers working at 160 lbs. pressure. On leaving the ways the vessel was named the *Sussex* by Mrs. Mathieson, of Hebburn.

Aqua.—On January 16th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 325 ft.; breadth extreme 48 ft.; depth, moulded, 24 ft. 3 in. The steamer has been built to the order of Sir Christopher Furness, West Hartlepool, for account of Messrs. Newman & Dale, London. The vessel is built on the three-deck rule, with one deck laid, having full poop, long bridge, and top-gallant forecastle. The saloon and cabins for the captain and officers will be fitted up in the poop, the accommodation for engineers under the bridge deck, and the crew will be berthed in the forecastle as usual. She has double bottom for water ballast on the cellular principle, fore and aft, and in large after peak tank. The vessel will carry about 5,200 tons deadweight on Lloyd's freeboard, is fitted with direct steam windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft, five large steam winches, supplied with steam from a horizontal multitubular donkey boiler, &c. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of about 1,100 I.H.P., steam being supplied by two steel boilers 15 ft. 3 in. by 10 ft. 3 in., their pressure being 160 lbs. per square inch. The christening ceremony was gracefully performed by Mrs. Newman, wife of the managing owner, who gave the vessel the name of *Aqua*.

Duncan.—On January 16th Messrs Cochrane & Cooper, Limited, launched from their Grovehill ship yard, Beverley, a new steam trawler of the following dimensions—113 ft. 8 in. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold, built to the order of Mr. William Grant, Grimsby. Engines of triple-expansion type, 12 in., 20 in., and 32 in., by 23 in. are being supplied by Messrs. J. Cran & Co., of Leith. The vessel will be completed ready for sea with all the most modern appliances for trawling. Mrs. Cochrane named the vessel s.s. *Duncan*.

Penmount.—On January 16th Messrs. William Gray & Co., Limited, launched the fine steel screw steamer *Penmount* to the order of Mr. Richard B. Chellew, of Truro. The vessel will take Lloyd's highest class, and her dimensions are: Length over all 312 ft., breadth 43 ft., and depth 22 ft. 3½ in. She has a full poop, long bridge, and top-gallant forecastle, joined by fore and aft gangways, tasteful saloon and cabins for officers, &c., will be fitted up aft, the engineers' rooms are in the bridge, and the crew's accommodation forward. The hull is built of the web frame system, with a cellular double bottom, and large aft peak tank for water ballast, large hatchways, five steam winches, steam steering gear amidships, hand-screw gear aft, large patent donkey boiler, patent direct steam windlass, boats on beams overhead, iron grain divisions, stockless anchors, two masts with schooner rig, and a complete outfit for a first-class cargo vessel. The Central Marine Engine Works of Messrs. William Gray & Co., Limited, supply fine triple-expansion engines of over 1,000 H.P., having cylinders, 22in., 35 in., and 59 in. diameter, with a 39-in. piston stroke, and two large steel boilers to work at a pressure of 160 lbs per square inch. The vessel has been built under the superintendence of Mr. John Chellew and Mr. George Hobson, and the ceremony of christening the steamer *Penmount* was gracefully performed by Miss Amy Corner, West Hartlepool. The *Penmount* is the seventh ship built by Messrs. William Gray & Co., Limited, for Mr. Richard B. Chellew.

Zinnia.—On January 16th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. the Stag Line, Limited, of North Shields, and of the following dimensions, viz.:—Length 345 ft; breadth 46ft. depth, 28 ft.: and to class 100 A1 at Lloyd's on the spar-decked rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including five double cylindered steam winches, direct acting steam windlass, large donkey boiler, steam steering gear by Messrs. Clarke Chapman & Co., Limited, and Hastie's screw gear aft. The engines which are to be supplied by Messrs. the North Eastern Marine Engineering Co., Limited, are of the triple-expansion type, having cylinders 23 in., 38½ in., and 64 in. by 42-in. stroke, and working at a pressure of 180 lbs. On leaving the ways the vessel was named the *Zinnia*, by Miss Kittie Robinson, of Ingleside, North Shields. This is the 19th vessel built by the Tyne Iron Shipbuilding Co., Limited, for Messrs. the Stag Line Limited.

Chester.—On January 16th there was launched by Mr. Joseph Scarr, Grovehill, Beverley, a steel tug boat of the following dimensions: 80 ft. by 17 ft. by 10 ft. She is the first built to the order of Mr. Bowman, of Hull, and was christened *Chester* on leaving the ways.

Vauxhall.—On January 17th Messrs. Irvine's Shipbuilding and Dry Docks Co., Limited, launched from their shipyard at West Hartlepool a finely modelled steel screw steamer, built for the West Hartlepool Steam Navigation Co., Limited. She is of the following dimensions:—Length, 352 ft.; breadth, 48 ft.; depth, 27¾ ft.: and of a measurement cargo capacity of 8,000 tons. She is of the single-deck type with poop, bridge and forecastle. The vessel is built to Lloyd's highest class under special survey, and is capable of carrying a large cargo on a light draught. A double bottom is fitted throughout on the cellular principle for water ballast, and the after peak is arranged as a trimming tank. She is constructed with deep frames, web frames, and longitudinal stringers, thus dispensing with hold beams, which gives clear holds for the storing of bulky cargoes. Six watertight bulkheads divide the holds; each hold is fitted with iron grain divisions. She also has extra large cargo hatches and is equipped with double derricks at each hatch, six steam winches, and all the latest improvements for rapid loading and discharging. The saloon and captain's and officers' accommodation is provided at the fore end of the bridge. The sanitary, ventilating and lighting arrangements are on the most approved lines. Engines of the triple-expansion type are being supplied by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, Middlesbrough, with cylinders 25 in., 40 in., and 66 in. in diameter with a stroke of 45 in., steam being supplied by two single-ended boilers constructed to work at a pressure of 160 lbs. The hull and machinery have been supervised during construction by Messrs. R. Craig and A. B. France, the owners' superintendents. A large company was present to witness the launch, and as the vessel left the ways the christening ceremony was gracefully performed by Miss Guthe, daughter of the managing director of the owners' company, who named the vessel *Vauxhall*.

LAUNCHES—Scotch.

Alpha.—On December 19th there was launched at Leith by Messrs. Hawthorn & Co. a steel screw steamer named the *Alpha*, built to the order of the Royal National Missions to Deep Sea Fishermen.

Argyll—On December 19th there was launched at Pointhouse, Partick, by Messrs. Inglis, the steel screw steamer *Argyll*, built for Mr. R. G. Reid, Newfoundland. The vessel is of 600 tons gross, and will have triple-expansion engines by the builders. She is the first of an order for six intended for trading on the coast of Newfoundland.

Anglia.—On December 20th there was launched at Dumbarton by Messrs. Wm. Denny & Brothers, a twin-screw steamer built for the London & North-Western Railway Co.'s channel service between Holyhead and Northwall. The vessel is a sister ship of the *Hibernia*, recently launched by Messrs. Denny, and a repeat of the *Cambria*, one of the most popular vessels engaged in the channel trade. She is a twin-screw steamer, having a length of about 340 ft., beam 39 ft., and a depth of 24 ft. to the awning-deck. She is practically a passenger steamer, carrying only parcels and passengers' luggage, and is intended to take her place along with the *Cambria* and her sister ship the *Hibernia*, on the company's Holyhead and Dublin service. This is the sixth vessel built by Messrs. Wm. Denny & Brothers, who have been entrusted with the contract of practically renewing the company's fleet of mail steamers. The ceremony of launching the vessel was performed by Mrs. Dorrington, wife of one of the directors of the London & North-Western Railway Co., who named the vessel *Anglia*.

Kharki.—On December 22nd there was launched at Irvine by the Irvine Shipbuilding and Engineering Co., Limited, a steel screw cargo steamer of about 850 tons deadweight for London owners. The vessel was contracted for through John White, Esq., shipbroker, London, and has been built to Lloyd's highest class under special survey, her dimensions being 185 ft. by 29 ft. by 14 ft., moulded. The vessel is of the raised quarter-deck type, with engines amidships, and has water ballast accommodation in cellular double-bottom throughout the vessel's length, also in fore and after peak tanks; powerful and compact deck machinery is being supplied, also steam steering gear, direct-acting steam windlass, &c. Triple - expansion machinery is being supplied by McKie & Baxter, Govan, Glasgow. The vessel on leaving the ways was gracefully named *Kharki* by Mrs. Hetherington, Greenbank, Cambuslang.

Lord Erne.—On December 22nd there was launched at Dumbarton, by Messrs. Archibald M'Millan & Son, Limited, the steel screw steamer *Lord Erne*, which is an addition to the fleet of the Lord Line of Messrs. Thomas Dixon & Sons, Belfast. The dimensions of the *Lord Erne* are 388 ft. by 48 ft. 6 in. by 29 ft. Her gross register is 4,320 tons, and her cargo capacity about 7,000 tons.

Pydna.—On December 29th there was launched at Port-Glasgow by Messrs. Russell & Co. a steel screw steamer of 4,650 tons deadweight carrying capacity named *Pydna*, for Messrs. Wm. Thomson & Co., St. John, New Brunswick. This makes the eleventh vessel built at Kingston for same owners during the last two years. Machinery will be supplied by Messrs. Kincaid & Co., Greenock.

Tilia.—On January 6th there was launched at Port-Glasgow, for the North-Eastern Steam Fishing Co., Limited, of Grimsby, an iron steam trawler, of about 185 tons gross, named the *Tilia*.

Saint Kevin.—On January 16th there was launched at Paisley, by Messrs. John Fullerton & Co., a steel screw steamer of about 700 tons gross register, which has been built to the order of Messrs. T. Heiton & Co., Limited, Dublin—Mr. Robert Harper, Glasgow, managing owner—and is a sister ship to the steamships *St. Mirren* and *St. Olaf*, built for the same owners. The steamer is specially designed and constructed for the Channel-carrying trade. Compound engines of 800 I.H.P. are to be supplied by Messrs. Hall-Brown, Buttery & Co., Ellen Street Engine Works, Govan. As the steamer started on the ways she was named the *Saint Kevin* by Mrs. J. Reid, Drumlanrig, Pollokshields, Glasgow.

Lakeside.—On January 17th there was launched by the Grangemouth Dockyard Co. a handsomely-modelled steel four-masted barquentine of the American type, built to the order of Mr. W. L. Lovitt, of Yarmouth, Nova Scotia. The dimensions of the vessel are 175 ft. by 35 ft. by 15 ft. 6 in. moulded, and she has a poop, long raised quarter-deck, topgallant forecastle, a house for the accommodation of the crew, and is fitted up in the most modern manner for working sails with the minimum number of hands. She is built on the bulb-frame principle, having one long clear hold for stowing lumber, of which it is expected she will carry 1,000,000 superficial feet, and she is fitted up with bow ports for loading and discharging timber. As she left the ways the vessel was named *Lakeside* by Miss Nellie Millar, daughter of Mr. Wm. Millar, partner of the Dockyard Co.

Tunisian.—On January 17th there was launched at Linthouse by Messrs. Alexander Stephen & Sons a twin-screw steamer of 10,200 tons, which they have built for Messrs. James & Alexander Allan, of Glasgow. The vessel is 520 ft. long over all, 59 ft. in beam, and 43 ft. deep, and she has been specially designed to meet the latest requirements of the Allan Line's Canadian trade. The hull is of steel to the requirements of the Board of Trade for foreign-going passenger steamers, and the construction and design have been under the special survey and with the scantlings required by the British Corporation for its highest class. There being between 5,000 and 6,000 tons of steel plates in her and a million and a half rivets. There is a cellular double bottom the full length of the ship, and the holds have been carefully sub-divided into watertight compartments, which have been constructed and stiffened on the most approved method. When completed, the vessel will have accommodation for about 200 first-class passengers on the upper bridge deck and in the fore end of the bridge deck, 260 second-class in the after part of bridge and on upper deck amidships, and a large number of third-class in upper deck aft, there being no fewer than 300 rooms. The first-class dining saloon is in the fore end of the bridge deck, and is a spacious apartment lighted from the front and the sides by means of specially constructed lights, and overhead by a well with a cupola skylight on the top. Several of the first-class cabins are situated abaft of the saloon, but the bulk of the state-rooms, together with the music-room and smoking-rooms, are in a commodious deck-house on the upper bridge deck. At the fore end of this deck-house is the music-room, and at the after end the smoking-room, with the cabins between. The space outside this deck-house is reserved as a first-class sheltered promenade, the stanchions at the sides being carried up to support the shade deck, which, with the exception of a small part at the fore end, is entirely given up to first-class promenade. Above this deck a light boat-deck has been built for carrying the lifeboats. The second-class dining saloon, music-room and smoking-room are at the after end of the bridge deck on the shelter deck. The whole of the accommodation is self-contained, and every part can be reached without passengers having to go into the open. The third-class accommodation is a special feature of the vessel. The bulk of the rooms are arranged for four passengers. The dining saloon is at the after end of the upper deck, and extends the full breadth of the vessel. In a house on the shelter deck aft there is a smoking-room and a women's reading-room for the use of the steerage passengers. Being intended for the Canadian trade, special care has been paid to the heating arrangements. Throughout, the accommodation is heated by means of steam pipes, with regulating valves, so that a desirable temperature may always be maintained. Ventilation has also received careful attention, electric fans being used for the main corridors. The lavatories, pantries, galleys, &c., are fitted with patent ventilating side scuttles, which are so constructed that they can be left open irrespective of the weather. Provision has been made for a continuous service of hot and cold fresh and salt water. The vessel will be lighted throughout by electricity, for which there is a most complete installation. In addition, there will be electric bells to all the rooms, there being between fifteen and sixteen miles of electrical wires. The steering gear is by Brown Brothers, of Edinburgh, and has all their latest improvements. The cargo gear is very complete, and there is a windlass and capstan forward and a warping winch aft. There is a large insulated space aft for carrying frozen meat, with an engine on the carbonic anhydride system. The engines and boilers are being supplied by the builders, and consist of two sets of triple-expansion engines and a set of seven single-ended boilers. She is a sister ship, but of greater power and accommodation, of the *Bavarian*, recently built by Messrs. William Denny & Brothers, Dumbarton, and at present engaged in the Government transport service. Miss Dunlop performed the christening ceremony, naming the vessel *Tunisian*.

Shunkai Maru No. 1.—On January 18th, Messrs. William Simons & Co., Limited, Renfrew, launched complete the *Shunkai Maru No.* 1, a steel twin-screw hopper dredger, constructed to the order of the Osaka Harbour Board, Osaka. The vessel, which is to be employed in the improvement of the Osaka harbour, is classed at Bureau Veritas, and was constructed under the inspection of Mr. C. Shiba, London, inspecting engineer of the Osaka Harbour Board in this country. She has a hopper capacity for 600 tons of spoil, and the buckets are of ample capacity to raise 500 tons of free soil per hour, having a maximum dredging depth of 36 ft. below water level. The propulsive power is supplied by two sets of compound surface condensing engines and two mild steel boilers of 120 lbs. working pressure, either set of engines being capable of driving the dredging gear. The hopper doors are raised by steam appliances: powerful steam winches are provided at bow and stern for manœuvring the vessel when at work. The vessel is lighted throughout by electricity, and comfortable quarters are provided for officers and men.

G. A. Savage.—On January 18th there was launched at Troon, by the Ailsa Shipbuilding Co., a steel-screw cargo steamer which they have built for the Zillah Shipping and Carrying Co., Limited, of Warrington. The steamer is intended to carry about 370 tons gross, and is to be engined by Messrs. Ross & Duncan, Govan. She was named *G. A. Savage*.

Mountoswald.—On January 18th there was launched from Glen Yard, Port-Glasgow, by Messrs. William Hamilton & Co. a steel screw steamer for Messrs. Lunn & Maccoy, Newcastle-on-Tyne, for the general carrying trade. The following are the dimensions:—Length, between perpendiculars, 330 ft.; breadth, 45 ft. 6 in.; depth, moulded, 26 ft. 6 in. She is designed to carry 5,450 tons deadweight on a light draught, with a nett register tonnage of about 2,085 tons. The propelling machinery, which is being supplied by Messrs. David Rowan & Co., of Glasgow, consists of one set of triple-expansion engines, having cylinders 24 in., 40 in., and 65 in. diameter respectively, by 42 in. stroke, steam being supplied by two large boilers constructed for a pressure of 180 lbs. As the vessel left the ways she was named the *Mountoswald* by Miss Lunn, daughter of one of the owners. Immediately after the launch, which was most successful, the vessel proceeded to Glasgow to receive her machinery. The *Mountoswald* is a duplicate vessel to the *Cragoswald*, built by Messrs. Hamilton for the same owners last year.

Florence.—On January 20th there was launched at Bowling, by Messrs. Scott & Sons, a screw steamer of the following dimensions:—Length, 95 ft.; breadth 21 ft. 6 in.; and depth, moulded, 10 ft. 6 in. She has been built to the order of Messrs. Joseph Monks & Co., Limited, Warrington. Engines of the compound surface-condensing type, will be supplied by Messrs. Ross & Duncan, Govan. On leaving the ways the vessel was named *Florence*, by Miss Florence Topham, daughter of Mr. C. Topham, Ulverston.

Clyde.—On January 22nd there was launched from Pointhouse Shipbuilding Yard, a screw vessel, the third of the steamers for Mr. Reid, of St. John's, Newfoundland. She was named *Clyde* by Miss Reid, of Coupar-Angus, sister of the owner.

Custodian.—Lately there was launched at Whiteinch by Messrs. Charles Connell & Co. a large twin-screw cargo-carrying steamer. Dimensions:—Length 498 ft. by 57 ft. 3 in. broad, by 46 ft. 8 in. in depth, with a deadweight of 9,200 tons; total carrying capacity, 12,250 tons. Dunsmuir & Jackson, Govan, supply the engines. The vessel was named *Custodian*.

LAUNCH.—Irish.

Saxon.—On December 21st the Royal Mail steamer *Saxon*, built by Messrs. Harland & Wolff, of Belfast, for the Union Steamship Company, was successfully launched from the south end of Queen's Island, Belfast. The new vessel is the largest and most powerful that has yet been constructed for this well-known company, and may be described as an improved *Briton*, being both larger and having more power than that vessel, which was launched by the same builders in June, 1897, the event being taken advantage of by the Chairman of the Union Company, Sir Francis Evans, K.C.M.G., M.P., and the Right Hon. W. J. Pirrie, who was then Lord Mayor of Belfast, to celebrate the progress in naval architecture during her Majesty's reign. The *Briton* is a favourite in the South African passenger trade, and the new vessel, the *Saxon*, will of course embrace all the improvements that have been effected since the former was built. The *Saxon* is the third mail steamer built by Messrs. Harland & Wolff for the Union Line, the other two being the *Norman* and *Briton*, but she is the twelfth vessel altogether built by them for that company, including the intermediate boats known as the "G.'s." The *Saxon* is 585 ft. 6 in, long by 64 ft. beam and 42 ft. 9 in. deep, and will have a gross tonnage of 12,970. The passenger accommodation will be very large, and a noticeable feature will be the size of the state-rooms, making them exceptionally large, airy, and comfortable. The first-class accommodation will be on the bridge, upper and middle decks, and the second-class on the middle decks. Besides the open-berth steerage accommodation forward, there will be provision for a large number of third-class passengers in the poop and after middle 'tween decks. A separate galley and pantry will be provided for the third-class passengers. The first-class saloon will be situated on the upper deck; it will be very handsome, spacious, and will have seating accommodation for a large number. The first-class library and drawing-room, as well as the smoking-room, will be on the promenade deck, and they will be very large and elegantly furnished. The entrance to the second-class saloon will be provided with sofas, and will make a comfortable apartment for ladies who wish to have a sitting-room on deck. Large promenade decks will be a feature in the new steamer, as they are in the *Norman* and *Briton*. The officers will have well-ventilated rooms, conveniently situated on the boat deck. The *Saxon* is fitted with two sets of quadruple-expansion engines, arranged on the balance principle to minimise vibration, and she is designed for carrying a large cargo or a considerable number of troops. All the twelve vessels built by Messrs. Harland & Wolff for the famous Union Line are twin screws, and each has been of special design, embodying all the latest improvements in naval architecture, and peculiar interest attaches to the launch of the *Saxon*, as forming another link in the chain binding the mother country to her distant colonies. The putting of the *Saxon* into the water brings a number of incidents to a satisfactory and successful termination. She was the last boat launched in 1899 by our premier shipbuilders, who easily headed the list again with seven enormous vessels of an aggregate tonnage of 82,634 and 66,150 I.H.P. The builders commenced the year with that huge leviathan, the greatest ship of the century, the *Oceanic*, and they have concluded it with the *Saxon*, which will be by far the largest and finest vessel ever built for trading to the Colonies. And there is also another interesting fact to note, viz., that this event completes a stage in the history of the Union Line, as the *Saxon* is probably the last launch under the old *regime*, as the Union and Castle Lines have declared their intention to amalgamate, so that succeeding ships (and we trust there will be many to follow in the near future) will, of course, come under the new arrangement. Miss Evans, daughter of Sir Francis Evans, M.P., Chairman and Managing Director of the Union Company, gracefully christened the new vessel the *Saxon* as she began to glide down the ways

LAUNCH.—German.

Sambia.—On December 29th a large first-class steel screw cargo steamer, built to the order of the Hamburg-American Line, was safely launched from the yard of the Flensburg Shipbuilding Co. Her principal dimensions are: 415 ft. by 50 ft. 2 in. by 31 ft. 4 in. moulded, having a deadweight carrying capacity of about 7,500 tons. The vessel is classed to German Lloyd's highest class, and is fitted with accommodation amidships and wood decks over all. She will be supplied with a large number of winches, derricks, and every other convenience for facilitating the quickest possible loading and discharging of cargoes. Triple-expansion engines of 2,000 I.H.P. will be supplied by the engineering department of this firm. On leaving the ways the christening ceremony was gracefully performed by Miss Adelheid Menzell, of Flensburg, who named the vessel *Sambia*.

LAUNCH.—Norwegian.

Peter Hamre.—A steel cargo screw steamer launched by the Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, The vessel is of the following dimensions:—Length over all 245 ft.; breadth 32 ft.; depth 16 ft. 1 in. This steamer has been built to the order of H. Hamre, Esq., Bergen, and to Norwegian Veritas highest class. *Peter Hamre* has cellular double bottom for water ballast and afterpeak ballast tank, and will be provided with three of Messrs. Clarke, Chapman & Co.'s steam winches, Emerson-Walker's patent steam anchor windlass, Fisher's patent steam-steering gear, Bower's patent rapid-closing apparatus for stop valve, worked from bridge as well as from engine-room, Bower's patent protection box for propeller shaft, and large donkey boiler; triple-expansion engines by the Laxevaags Engineering and Shipbuilding Co. Cylinders 16 in., 25½ in., 42 in., and 30 in. stroke. The boiler, 14 ft. 1 in. in diameter, 10 ft. 6 in. long, for a working pressure of 175 lbs.

TRIAL TRIPS.

Granada. — On December 15th the steel screw steamer *Granada* proceeded from the Wear for her trial. The vessel (of which we gave particulars in our October issue, page 321), has been built by Messrs. John Priestman & Co., Southwick, to the order of Messrs. A. C. de Freitas & Co., Hamburg, for the Argentine and Canadian cattle trade. The trial trip resulted in a speed of 12 knots being attained.

Rapid. — On December 15th the trial trip of the steam trawler *Rapid* took place, and proved satisfactory, a speed of 10½ knots being attained on the measured mile. The vessel (of which we gave particulars in our December issue, page 421) was built by the Irvine Shipbuilding and Engineering Co., Limited, Irvine, for the Peterhead Trawling Co., Limited.

Caucasian.—On December 19th this vessel built to the order of Messrs. Lane & MacAndrew, of London, by Messrs. Sir James Laing & Sons, Limited, of Sunderland, of which we gave particulars in our December issue, page 415, was taken for her trial off the latter port, when she made an average speed of over 10¼ knots. The machinery throughout was subjected to an exhaustive trial, which proved quite satisfactory.

Verona. On December 20th the large steel screw steamer *Verona* proceeded on her official trial trip in Hartlepool Bay. The *Verona* (of which we gave particulars in our October issue, page 329), has been built by Furness, Withy & Co., Limited, Hartlepool, to the order of Sir Christopher Furness, J.P., D.L., for Messrs. R M. Sloman & Co., Hamburg. The vessel attained a speed of 11½ knots. The owners were represented by Captain Jorgensen and Herr von Essen, and the builders by Mr. G. W. Sivewright. After the trial trip the vessel proceeded to the Tyne for bunkers.

Galeka.—On December 23rd the new steamer *Galeka* proceeded down Belfast Lough for trial trip and adjustment of compasses. The *Galeka* (of which we gave particulars in our December issue, page 421), has been built by Messrs. Harland & Wolff, Limited, for the Union Steamship Co., Limited, and is a twin-screw steamer 440 ft. long. 53 ft. broad, 33½ ft. deep, and of 6,763 tons gross register. After trial the ship left the lough for Antwerp, Captain Bremner being in command.

Dordrecht.—On December 29th the *Dordrecht* left the Tyne for her loaded trial trip. She has been built by Mr. Jan Smit Cz, of Alblasserdam, Holland, to the order of Mr. Ph. van Ommeron, of Rotterdam, and is of the following dimensions, viz.:—Length, 293 ft.; beam, 42 ft. 9 in.; draft (loaded), 18 ft. 7 in. She is fitted with a set of triple-expansion engines, constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, having cylinders 21¼ in., 35½ in., and 39 in. by 39 in. stroke, and two large steel boilers built by the same firm, working at 160 lbs. pressure. During the trial the machinery worked without the slightest hitch, and gave every satisfaction to Mr. Ellmer, the owner's representative.

Daphne.—On December 30th the new steamer *Daphne*, which has been built by Messrs. Wood, Skinner & Co., Limited, Bill Quay, to the order of Mr. Johannes Bull, of Tonsberg, Norway (of which we gave particulars in our December issue, page 417), had her official trial trip off the Tyne, and despite the unfavourable state of the weather, both vessel and machinery proved in every way satisfactory, a mean speed of 11 knots being obtained.

Drachenfels.—On January 3rd the s.s. *Drachenfels* went for a short trial trip before sailing from the river. The steamer has been built and engined by Wigham-Richardson & Co., Limited, at their Neptune Works, Newcastle-on-Tyne, for the Indian Service of the Deutsche Dampfschifffahrts Gesellschaft *Hansa*, of Bremen. The steamer is 470 ft. in length by 58 ft. beam, and will carry over 10,000 tons deadweight. She is fitted with a set of four crank quadruple-expansion engines on the Yarrow, Schlick & Tweedy system, working at 210 lbs. pressure, which on the trial trip gave complete satisfaction to all. The owners were represented on the trial trip by Mr. D. Wulff, of Bremen, their superintendent engineer. Immediately after the trial the vessel sailed for Cardiff, under the command of Capt. Hanssen, to load for her outward voyage.

Aero. – On January 6th the small steel screw passenger and mail steamer *Aero*, built by the Flenburg Shipbuilding Co., to the order of the Dampskibsselskabet *Aero*, of Aeroskjobing, put out to sea for her official trial trip. Her principal dimensions are:—87 ft. 6 in. by 17 ft. 8 in. by 7 ft. 11 in. She is fitted with handsomely furnished first-class saloon aft, and comfortable second-class saloon forward. The owners of this vessel have been subsidised by the Danish Government to run her between Aero and Fijn, carrying mails and passengers to and fro. She has been fitted with compound engines, having cylinders 14 in by 26 in. by 16 in. by the engineering department of this firm. On conclusion of the trial, the owners expressed themselves perfectly satisfied with the workmanship, both of the hull and machinery.

Helsingborg.—On January 8th was witnessed the trial trip of the fine steel screw steamer *Helsingborg* (of which we gave particulars in our December issue, page 416), which Messrs. Wm. Gray & Co., Limited, have built to the order of the Rederiaktiebolaget of Helsingborg (Mr. N. C. Corfitzen, manager). The vessel was in ballast trim, and with the log overboard averaged a speed of ten and a half knots, the performance of ship and machinery being highly satisfactory. She afterwards proceeded to Methil, where she loads for St. Nazarre.

Northlands.—On January 10th the fine steel screw steamer *Northlands*, built by Messrs. William Gray & Co., Limited, to the order of Messrs. Jones & Hallett, of Cardiff (of which we gave particulars in our January issue, page 476), was taken to sea for her trial trip, which was a highly satisfactory one, everything passing off without a hitch. The vessel on its conclusion proceeded to Hull, where she takes in a cargo of coal for South Africa.

Macedonia.—On January 13th the fine steel screw steamer *Macedonia*, built by Messrs. Craig, Taylor & Co., Stockton (of which we gave particulars in our December issue, page 418), left the Tees for her trial trip, during which the engines worked with the greatest smoothness, giving entire satisfaction, and a speed of 12½ knots was easily maintained, under adverse circumstances. The owners, Messrs. A. C. de Freitas & Co., Hamburg, were represented by Captain G. Cantieny (who has taken command of the vessel), and also Mr. Max Rother, who both expressed themselves as being highly pleased with the ship and engines. This is the sixth vessel that Messrs. Craig, Taylor & Co. have built for Messrs. A. C. de Freitas & Co.

Capri.—On January 15th the steamship *Capri*, a wood-cargo steamer, built by Messrs. Brunchorst & Dekke, Bergen, Norway, went on her trial trip. She has been built to the order of P. Hamre, Esq., Bergen. The vessel is 850 tons deadweight. She is provided with three steam winches and patent steam anchor windlass. The engines and boiler are built by the Laxevaags Engineering and Shipbuilding Co.. Bergen, Norway. The engines are of the triple-expansion type, about 380 I.H.P., with cylinders 12¼ in., 20 in. and 32 in., with 26 in. stroke. The machinery worked under the trial very satisfactorily, and a speed of 10½ knots was obtained. She is provided with Bower's patent rapid-closing apparatus for stop valve, worked from bridge as well as from engine room, and Bower's patent protection box for propeller shaft. The vessel and her machinery have been built under the superintendence of C. Dahm, Esq., Bergen. The managing owner and a large company of ladies and gentlemen were present on her trial trip. The trial was in every way a complete success.

Strombus.—On January 16th this vessel was taken for her trial trip by Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited, of Newcastle, by whom she had been specially constructed to the order of Messrs. M. Samuel & Co. (Shell Transport and Trading Co., Limited), of London, under the direct supervision of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool (of which we gave particulars in our December issue, page 419). The liquid fuel arrangements have been subjected to exhaustive trials, and have proved in every way satisfactory, the steam being well maintained. The owners and their consulting engineers feel perfectly assured that the vessel's performance will be satisfactory in every way. On the trial trip the average speed was 10·6 knots.

Engineer.—On January 17th the s.s. *Engineer*, built to the order of Messrs. Tatham, Bromage & Co., of London, for the Engineer Steamship Co., Limited (of which we gave particulars in our January issue, page 478), went down the Firth of Forth on her trial trip. As a mean of two runs between Inch Keith and Oxcar Light a speed of 11¾ knots was obtained, the engines, supplied by Messrs. Hutson & Sons, Kelvinhaugh, Glasgow, and having cylinders 16 in., 26¼ in., and 45 in. by 33 in., supplied with steam by one large boiler of 170 lbs. working pressure, worked perfectly smoothly throughout the trial. The owners were represented by Mr. Walter Phillips, 98, Leadenhall Street, London, who superintended hull and machinery during construction, assisted by Mr. George B. Wemyss, of Oswald Street, Glasgow This vessel has been built specially with the view of carrying locomotives or boilers of large dimensions, and is provided with steel derricks and powerful steam winches capable of lifting 15 tons, and special hatches of very large size. At the conclusion of the trial the owners' representative expressed himself as highly satisfied with the working of both ship and machinery.

London Bridge.—On January 19th the new steamer *London Bridge*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Messrs. Furness, Withy & Co., Limited, of West Hartlepool, for account of the Bridge Steam Shipping Co., Limited, of London (of which we gave particulars in our January issue, page 477), made her official trial trip in the Tees Bay. After the adjustment of compasses, she proceeded on her run to London, from thence to Newport (Mon.) to load for Madras. The vessel has been built under the inspection of Mr. M. Havelock, of Newcastle-on-Tyne, and Captain Eugene Chilvers, the commander of the vessel. These gentlemen, together with the owners (Messrs. Moore, Innes & Co.), were present at the trial, and expressed entire satisfaction with the vessel. The builders were represented by Mr. Leonard Ropner.

Rosalie.—On January 19th the *Rosalie*, built by the Northumberland Shipbuilding Co , Limited, of Howdon-on-Tyne, and owned by Messrs. John Cory & Sons, Limited, of Cardiff (of which we gave particulars in our January issue, page 476), left the Tyne for her trials. The propelling machinery has been constructed by the Wallsend Slipway and Engineering Company, Limited, with cylinders 23 in. 38½ in., and 65 in. diameter. by 48 in. stroke, the working pressure being 180 lbs. Throughout the trial trip the engines ran most satisfactorily, the vessel maintaining a speed of over 11 knots per hour, the I.H.P. being over 2,000. Afterwards the *Rosalie* left for Cardiff under the command of Captain Pengelly, where she will load preparatory to her first voyage.

Celderland.—This vessel has been taken on her trial off the Tyne. She was constructed by the Blyth Shipbuilding Co , and is a single-deck ship built to Lloyds 100 A1 class, of the following dimensions:—Length, 249 ft.; beam, 36 ft. 9 in.; and depth, moulded, 18 ft. 4 in.; built on the deep frame principle, carrying 2,250 tons on a light draught. She is owned by the Shipping & Coal Co., of Rotterdam, and has been surveyed by Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. The engines are by Messrs. MacColl & Pollock, of Sunderland, and have cylinders 20½ in , 33 in., and 54 in. by 36 in. stroke, supplied with steam by two large double-ended boilers. The vessel is fitted with powerful auxiliary engines for quick despatch of cargo, and for working the vessel, including large vertical donkey boiler, four steam winches, steam windlass, and steam steering gear. A speed of 11 knots was made on the trial.

Messrs. Geipel & Lange report that their business during the past year has steadily increased in all branches, The sales of the Geipel steam trap have been nearly double that of any previous year. They have been fitted on the new Royal yacht and on a large number of H.M. war vessels, while orders have been received from most of the foreign admiralties. About 70 of these traps will be used at the forthcoming exhibition in Paris. The new bayonet lampholder, introduced by this firm, is meeting with approval, more especially for 200-volt work. They have been engaged in fitting up transmission of power in the following works, viz.:—Patent Shaft and Axletree Co., Limited, Wednesbury; the Bristol Wagon and Carriage Works, Co., Limited, Bristol; Anglo-Swiss Condensed Milk Co's. factory in London; at the same company's factory at Aylesbury; and Brown, Marshalls & Co., Limited, Birmingham - all of which are worked on the three-phase system.

Correspondence.

[In giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions expressed therein. —Ed. M.E.]

JAPANESE INSTITUTION OF NAVAL ARCHITECTS.

To the Editor of the Marine Engineer.

Sir,—I regret to say that the information which was sent to you relating to the Japanese Institution of Naval Architects was written in poor English, which has caused your misunderstanding, and I have to write to you to correct my mistake. The subject of Mr. Iwata's speech was "a composition to prevent the tube-ends and the furnace junction to the combustion chamber from leaking." The patent was granted for the above composition to Mr. Iwata and not to me. I should be very much obliged if you would correct the errors of your description with regard to the same.

I remain, dear sir,
Yours very truly,
S. Tsutsumy.

Tokio, Japan,
December 15th, 1899.

P.S.—I make bold again to inform you about the trials of the new steamer *Swa-Maru*, built for the Nippon Yūsen Kaisha (Japan Mail Steamship Co.) by the Mitsu-Bishi dockyard of Nagasaki. The vessel, intended for the Yūsen Kaisha's European liners, is of the following dimensions: length, 443 ft.; breadth, 49 ft.; depth, moulded, 33½ ft. Her gross registered tonnage is 6,309. The machinery consists of two sets of tri-compound engines, having cylinders of 20 in., 33½ in., and 56 in. by 48 in. stroke. Each condenser has a cooling surface of 2,353 square feet. The four-bladed propellers, made of manganese bronze, are of 15 ft. diameter by 18 ft. 3 in. pitch. The steam is supplied by two double-ended (13 ft. 3 in. diameter by 17 ft. long) and two single-ended cylindrical boilers (13 ft. 3 in. diameter by 10 ft. long), of 106 and 52 square feet of grate area respectively, and the total heating surface of 9,156 square feet, working at a pressure of 200 lbs. per square inch. The first trial took place on the 2nd ult. at Nagasaki, to ascertain her maximum H.P. (a subsidy of five yen, or about 10s., was given by the Government for every one H.P. of the engines, according to the Shipbuilding Encouraging Act). The mean speed of six runs at a distance of 3·458 miles was 14·03 at a mean draught of 16 ft. 10½ in. and a displacement of 7,860 tons. The total H.P. obtained was 4,112 (port 2,064, starboard 2,048), and number of revolutions 81 at port and 82 at starboard. The second trial was to obtain the maximum speed with a light draught (mean draught of 15 ft. 2 in. and a displacement of 6,770 tons), and took place on the 5th inst. at the Tokio Bay, when the mean speed of six runs on the mile posts (three miles apart) was 14·54. The trial was in every way satisfactory, and the total H.P. obtained was 4,448 (2,198 starboard, 2,250 port), and number of revolutions was 85·5 at starboard and 84 at port. The vessel will leave Yokohama to-morrow (December 16th) for her maiden voyage to Europe.

OBITUARY.

JOHN SHORT, SHIPBUILDER.

On going to press, we hear with sincere regret of the death of Mr. John Short, on the 24th inst. He was discussing business matters with Mr. William Allan, M.P., in his office, at Sunderland, when he suddenly sank back in his chair and expired. He was 56 years of age. Mr. Short, who was head of the shipbuilding firm of Messrs. Short Brothers, was also largely interested in the timber trade, a director of the Westoll Line of steamers, the largest in Sunderland, and a member of the firm of Messrs. Lowther, Latta & Co. He was also a member of the River Wear Commission, and of the Sunderland Town Council, and chairman of the Shipowners' Society. He was recently asked, but declined, to stand as one of the Liberal candidates for Sunderland at the next general election.

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 15th, 1899, to December 6th, 1899.

22732	H. H. Leigh. (F. J. Sprague, F. T. Bowles, and G. H. Hill, United States.) Watertight doors.
22744	A. Goodwin. Piston packing.
22745	J. Gibson. Loading coal in ships' holds.
22755	W. H. Willson and M. S. Conly. Engines.
22766	G. Green. Feed-water heaters for boilers.
22793	W. Clarke. Marine life-saving jacket.
22806	H. H. Lake. (F. A. Dalay, United States.) Furnaces.
22843	W. D. Hamilton. Water-tube boilers
22881	C. V. Suppan and B. Szendi Ship propellers.
22898	I. S. McDougall and N. N. Haigh. Feed-water filters.
22913	J. J. B. Arter. Friction clutches.
22931	A. Peter. Rotary pump.
22982	F. I. Grosse and P. Boubalt. Petroleum engine.
22997	W. H. Robinson. Wrenches.
23003	D. A. and J. B. Blair and R. Baillie. Condenser.
23007	L. Myers and F. R. Baker. Compass.
23043	C. R. Boswell. Valves for steam engines.
23053	G. V. L. Chauveau. Balanced engines.
23066	A. W. Baxter. Valve.
23091	A. F. Cole. Valves
23101	L. Wehner. Feed-water heaters and purifiers.
23126	T. W. Nordenfelt and A. Christophe. Generating steam.
23130	H. Lœwe. Crank driving mechanism.
23133	H. J. Kimman. Portable pneumatic tools.
23144	T. Melrose. Steam whipping engine.
23151	E. F. J. Spafford. Teaching the use of mariners' compass.
23152	R. Richardson. Direct-acting steam engines.
23162	G. R. Davies. Flue-cleaners for boilers.
23171	A. J. Boult. (C. F. Bainter, G. W. Possell, and C. M. Persons, United States.) Purifying feed-water.
23177	E. H. J. C. Gillett. Closing the ends of boiler tubes.
23186	H. J. Kimman. Pneumatic riveting device.
23189	J. A. Hopewell. Marine propellers.
23198	J. Maudslay. Steam generators.
23199	B. E. Dickinson. Friction clutches.
23211	J. P. Cowing. Bascule lift bridges.
23213	A. Colome's covering, &c. Leaks in ships.
23221	H. Loose and G. Schreyer. Self-acting lubricator.
23232	J. Aufreckt. Rotary engine.
23238	E. A. Ventillard and E. Scherding, jun. Injecting fuel into furnaces.
23248	W. E. Hickling. Apparatus for raising water.
23332	G. A. Newton. Boiler furnaces and flues.
23341	F. W. Lanchester. Vaporisers for engines.
23342	F. W. Lanchester. Packing of piston-rods.
23355	A. Kesson. Pumping machinery.
23370	T. Matthews and R. Howcroft. Metallic packings.
23385	N. Fortescue. Hopper barges.
23397	A. J. van Stockum Gear for torpedoes.
23430	J. Brown. Shipbuilding.
23434	J. Patterson. Reversing gear for engines.
23446	J. Smit. Prevention of incrustation in boilers.
23479	F. Goodwill. Otter board for trawl nets.
23553	A. Coard. Engine.
23568	Sir W. G. Armstrong, Whitworth & Co., Limited, and E. L. Orde. Burners for liquid fuel.
23569	Sir W. G. Armstrong, Whitworth & Co., Limited, and E. L. Orde. Supporting burners.
23570	Sir W. G. Armstrong, Whitworth & Co., Limited, and T. Wyse. Attachable designs.
23573	A. J. D. Boult. (C. de Haupt, Belgium.) Engine valves.
23670	W. Robins. Fixing valves to pumps.
23673	W. H. Booth. Pumping machinery.
23677	H. Bowman and J. T. Southworth. Pumps.
23694	J. Wright. Surface heaters or condensers.
23700	J. and R. Temperley. Valves for steam engines.
23707	B. Ljungström. Balanced rotary steam engines.
23744	C. G. Borthwick. Internal combustion engines.
23751	J. H. Darragh. Rotary engine.
23779	G. H. Attrill. Collapsible rowing crutch.
23793	E. W. Wynne. Steam boilers.
23825	W. Reavell, E. B. Ball, and Reavell & Co., Limited. Shaft governors for motive power engines.
23847	T. R. Smith. Rotary engine.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.

January 20th, 1900	Bulow, Viggo C.......	Ex 1C	London
,, ,,	Deans, Alex. R.	Ex 1C	,,
,, ,,	Kluge, Thomas E.....	Ex 1C	Swansea
,, ,,	Olford, Frank, ...	Ex 1C	Plymouth
,, ,,	Simpson, James	Ex 1C	Liverpool
,, ,,	Williams, Harry A. ..	Ex 1C	Cardiff

NOTE.—1C denotes First Class; 2C Second Class.

December 16th 1899.
(Continued.)

Macpherson, D.	1C	Liverpool
Matthewson, J.	1C	N.Shields
McDougall, J.N.	2C	Greenock
McDuff, John..	2C	,,
McLean, Jas. ..	1C	,,
Montgomery, S.	1C	London
Moore, Thomas	1C	Liverpool
Munton, Wm...	2C	N.Shields
Murray, Thomas	2C	Liverpool
Porter, Geo. F.	2C	London
Ridley, A. E. ..	2C	,,
Robson, Wm. ..	1C	N.Shields
Shaw, David R.	2C	Leith
Sinclair, Wm...	2C	,,
Vasiliades, C. ..	2C	Greenock
Watson, R. P...	2C	Hull
Wilkinson, Wm.	2C	,,
Williams, G. S.	1C	Liverpool

December 23rd.

Anderson, J. W.	2C	London
Atkinson, R. H.	1C	,,
Ball, George ..	2C	Cardiff
Barr, David C.	2C	Glasgow
Beilbey, N. H...	1C	N.Shields
Bell, Frederick	1C	,,
Boyd, A. E.....	1C	Cardiff
Brown, D. S. ..	2C	N.Shields
Buglass, R.W.B.	1C	Dundee
Campbell, P. ..	2C	Glasgow
Cochran, J. F...	1C	Dundee
Crawford, John	2C	Glasgow
Davison, Fredk.	2C	N.Shields
Dent, Thos. A.	2C	Cardiff
Dixon, Tom....	1C	N.Shields
Elliott, John W.	2C	W. Hart'l
Fernie, David M	1C	Dundee
Forde, Thos. A.	2C	Cardiff
Garnett, J. A...	2C	W.Hart'l
Gillies, Thos. C.	2C	Bristol
Gleave, James..	2C	Liverpool
Gordon, J. F. ..	2C	Glasgow
Gore, David....	2C	N.Shields
Gresham, W. J.	2C	London
Hall, William ..	2C	W.Hart'l
Henderson, A.G.	2C	Glasgow
Henderson, C.N.	1C	N.Shields
Hunter, Hugh K.	1C	Liverpool
Hutchinson, C.	1C	,,
Jones, Charles..	1C	N.Shields
Jones, John M.	2C	Liverpool
Jones, Wm. E.	1C	Cardiff
Lowe, John W.	1C	W.Hart'l
MacLean, C. S.	2C	Glasgow
Marten, David H.	2C	Liverpool
Maxwell, David	2C	,,
M'Carthy, J. J.	1C	W. Hart'l
McFarlane, M.	1C	Glasgow
Mileson, G. E...	2C	N.Shields
Miller, D. A. ..	2C	Glasgow
Nicol, Donald..	1C	,,
Park, Wm. H...	1C	N.Shields
Payne, Wm. ..	1C	W.Hart'l
Pearson, Geo. P.	1C	N.Shields
Smith, E. M. ..	2C	Liverpool
Stephenson, WJ	1C	N.Shields
Stewart, N.....	2C	Liverpool
Summers, P. N.	2C	W.Hart'l
Umpleby, R. E.	2C	W.Hart'l
Wildsmith, E.G.	1C	,,
Williams, James	1C	London
Wood, John McI	2C	Glasgow
Woolfenden, W.	2C	Liverpool

December 30th.

Allan, George ..	2C	N.Shields
Brewer, C. W...	1C	Liverpool
Brewis, Joseph	2C	Sun'land
Brodrick, Harry	2C	Hull
Byrne, Alfred..	2C	Liverpool
Campbell, P J J	2C	London
Chadwick, J. M.	1C	Liverpool
Cockayne, H...	1C	,,
Cretney, W. D.	2C	,,
Cunningham, T.	2C	,,
Dakin, Norman	2C	Hull
Darling, John ..	2C	Liverpool
Dixon, Thomas	2C	N.Shields
Downie, A. C...	1C	Liverpool
Duffy, James ..	1C	N.Shields
Earle, Wm. R.	2C	,,
Henderson, Jas.	2C	Aberdeen
Hind, Frederick	2C	N.Shields
James, Wm. F.	2C	London
Mills, Andrew ..	2C	Sun'land
Mohrke, A. W.	2C	,,
Morris, R.	2C	Liverpool
Nicolson, W. J.	2C	Aberdeen
O'Neil, R. S. ..	2C	London
Pascoe, George	1C	Liverpool
Pickering, H. W.	2C	,,
Plater, H. T. B.	2C	London
Prentice, T.S.M.	1C	,,
Purvis, John ..	1C	N.Shields
Reay, Gabriel ..	2C	Sun'land
Ross, Robert ..	1C	N.Shields
Shakle, Jas. G.	1C	London
Thompson, H.G.	2C	Liverpool
Tulloch, Jas. E.	1C	Aberdeen
Tunley, Percy J.	1C	Hull
Whitworth, I W	2C	N.Shields
Williamson, J R	1C	Liverpool
Worden, R. A.	2C	Sun'land
Young, Geo. A.	1C	London

January 6th, 1900.

Adam, John ..	1C	Glasgow
Charles, W. N.	2C	Cardiff
Cooper, R. W...	1C	,,
Davies, Enoch	1C	S'thmptn
Evans, Evan ..	1C	Cardiff
Evans, G. H. ..	2C	,,
Ferguson, J. ..	2C	Glasgow
Ferguson, John	2C	,,
Galloway, Robt.	2C	,,
Grieve, Thomas	2C	,,
Hughes, J. M...	2C	S'thmptn
Johnston, A. ..	1C	Glasgow
Louttit, J. W...	2C	,,
MacKinnon, D.	1C	,,
Mayer, Thos. ..	1C	,,
M'Clafferty, J...	2C	,,
Meiklejohn, A.A.	1C	,,
M'Intosh, D. J.	1C	,,
Munro, W. E...	2C	,,
Neilson, T. J...	2C	,,
Richards, E. W.	2C	Cardiff
Ritchie, Jas. ..	1C	Glasgow

THE NEW YORK PUBLIC LIBRARY
ASTOR, LENOX AND

The Marine Engineer.

LONDON, MARCH 1, 1900.

A DISCOURSE at an evening meeting of the Royal Institution was given by the Hon. C. A. Parsons upon "Motive Power, High-speed Steam Turbines," which after a slight ancient historical introduction launched into a full historical account of the introduction and development of steam turbines. The account illustrated well the slow and gradual perfecting of so novel an invention as that of a steam turbine, showing that all such novelties grow gradually to perfected form by the co-operation of many minds and according to the particular demands for useful application in the market. Even as far back as 1884 experiments were begun for the construction of a steam turbine to drive a dynamo, the turbine to run as slow, and the dynamo as fast, as possible to admit of direct coupling. Special bearings were devised to keep down vibration. The turbine itself made 18,000 revolutions a minute, and consisted of 15 successive turbine wheels, gradually increasing in size to allow for the expansion of the steam, and was of 10 H.P. In 1888 several turbo-alternators were supplied of 120 H.P. running at nine or ten thousand revolutions a minute, and thus coming down to a more practicable speed. It was found that these turbines took about 35 lbs. of steam per electrical, H.P. which was not so very bad a comparison with direct high-speed reciprocating engines. In 1892, however, the adaptation of turbines, of the radial flow type to work with condensers, marked a new epoch in steam economy, and the steam consumption has since been decreased to 18 lbs. of steam 10 degrees superheated per kilowatt-hour. This direct driving of dynamos by a high-speed rotary engine was an obvious adaptation of great commercial value as adapted to drive also a rotary machine which itself required to revolve at a very high speed. When, however, it came to adapting such turbo-motors to the propulsion of boats, the difficulty at once arose that no ordinary propeller was adapted to run at the economical speeds of the turbo-motors, and therefore could not be driven direct. Any indirect coupling by gearing at once destroyed half the advantage commercially of the adaptation of turbo-motors to screw propulsion. From this point a new departure in invention had to be taken to discover a form of propeller or propellers which could be directly driven by such turbines at a high speed. Many trials were made with various propellers, but the speed obtained was very disappointing owing to the excessive slip and inefficiency of the ordinary forms of propellers, resulting in great "cavitation" behind the propeller blades and great consequent loss of power. At last the multiple propeller of coarse pitch and large blade area with small diameter, resulting in three propellers on each shaft and a multiplication of shafts, gave excellent results, giving almost a duplication of the speed. The *Turbinia*, as is now well known, had three separate engines—high pressure, intermediate, and low pressure, each driving one screw shaft, and each shaft carrying three propellers. There was little vibration and the engines worked economically. We see that one of the latest torpedo-catchers built for the Government, and engined with the Parsons turbo-motor, is the fastest catcher afloat, having developed a speed of over 35 knots, or 41 miles per hour. The engines are similar to those of the *Turbinia*, but are two distinct sets, working on four shafts and developing an I.H.P. of 11,000. It is interesting to note the development of horse-power for the various maximum speeds of torpedo-catchers. The power for 26 knots was only 12⅓ I.H.P. per ton of displacement; 27 knots required 15¼ I.H.P.; 30 knots required 20 I.H.P.; 32 knots required 24½ I.H.P., whilst for 35 knots 31½ I.H.P. is required.

WE were glad to see that Mr. Joy, in a discussion at the Institute of Marine Engineers upon a paper read by Mr. J. F. Walliker on "Twenty years of Progress in Cargo-boat Machinery," gave voice to a similar desire that we have often expressed that the sea-going members of the profession would give the shore members the great advantage of hearing more often their daily experience at sea, on so many points that are frequently only the basis of academic discussion in papers or text-books. Sometimes an ounce of hard fact and experience is worth a pound of theory, but in sea-going vessels incidents occur of the most deeply interesting character, as affecting the behaviour of the machinery afloat, that no one ashore, nor even other sea-going engineers, are likely to hear of or be the wiser for, from the very isolation of a ship at sea, unless those sailing in her, who saw and dealt with the matter and difficulties experienced, will bestir themselves to make public, for the benefit of their professional brethren, the occurrences in question. We have always taken much trouble to state that our pages are always open to communications from such sea-going engineers, and to the illustration of any rough sketches they might desire to send to illustrate the particulars or incidents they are describing. Very often the discussions upon papers read before engineers are more interesting than the papers themselves, as the discussion is often more replete with practical experiences than a formally written paper can be. It is these experiences, even as short incidents, that we would wish to collect and publish for the benefit of our readers and of the profession generally, and we should be glad if those at sea, or about to go to sea, to whom these remarks may come would act practically upon them, and try to commit some of their experiences to black and white.

GREAT interest has been taken in the emergency mounting of naval guns for land service by Captain Percy Scott and his engineer staff. We have now particulars to hand of the way in which this work was carried out. It would appear that Captain Scott suggested to the naval and military authorities on or about the 14th of October that the Boers would bring forward heavy siege guns, which would quite overmatch the military field pieces. However, no encouragement was given to the suggestion until receipt of an urgent wire from General White that he wanted guns of greater calibre and range than his 15-pounder R.A. guns. Then the suggestions of Captain Scott were eagerly seized upon if the guns could be got ready in time, which was short. Captain Scott undertook to prepare mountings for two 4·7-inch guns in 12 hours, and he did it within the time. He started upon them at 6 a.m., and by 5 p.m. of the same day he had delivered two 4·7-inch guns and mountings complete to the *Powerful*, and also four 12-pounder long guns, which he had before prepared on his own mountings on the *Terrible*. This was a record contract and splendidly carried out, having been stated by other experts to be an impossibility. The work was only effected by the rough and ready but practical character of the mountings. That of the 4·7-inch guns consisted essentially of four baulks of timber 12 in. square by 14 ft. long, arranged as a square, with projecting ends, as a base, and through bolted together. Upon the centre of the cross or square was bolted a socket platform, with a strong upstanding spindle, and upon this spindle was mounted the ordinary naval carriage of the gun, and the mounting was completed. It was found that this mounting could be placed on any level, hard base, and the firing of the gun produced only a slight recoil of the whole structure. The instructions for mounting on shore were to dig a hole 14 ft. square and 2 ft. deep for the platform cross, drop the platform in it, ship the carriage, and place the gun in the latter. Captain Scott eventually produced a more mobile form of mounting for the 4·7-inch guns when given time to work it out, and an excellent piece of rough engineering it was. Two heavy baulks were used as a double trail mounted at one end upon a strong axle. This was simplicity itself. The wheels, however, were a bothering job, but were made of circular discs of plate iron, with two heavy washers to form a boss for the axle, the rim being formed from an angle iron, riveted on either side of the plate disc, the whole being completed by a broad plate tyre shrunk over the angle irons, and the plate wheels were strengthened by angle iron ribs. This made a capital rough and strong job, with plenty of mobility, and so well were these extempore mountings and guns appreciated that it is understood that six 4·7-inch guns so mounted, and no less than twenty-two 12-pounder naval guns, all on Captain Scott's mountings, are with the various forces at the front. It is grand to see the sister services thus supporting one another, and that the engineering skill and ability of the naval service should have added so materially to the defensive and offensive operations of our land forces.

VARIETIES of opinions upon the relative merits and demerits of water-tube and the older cylindrical boilers are still as patent as ever. Those inclined to either opinion are still as emphatic as ever, that there can be no doubt whatever on the subject. The settlement of the question will only come with direct use and lengthy experience of the newer types of water-tube boilers as compared with their older rivals. There is no doubt that such practical experiences will do much to modify forms and dimensions, to give better durability and accessibility for repairs or cleaning. We heard the other day that the Admiralty had determined for the future not to admit specifications of water-tube boilers, with tubes of less diameter than 3 in., and that 3½ in. is the preferred diameter. In consequence, one of the most successful and enterprising firms in the making of water-tube boilers immediately tested a boiler constructed with this size of tube throughout, and found the result so satisfactory that they have determined to alter some of their orders in hand to this size of tube. There is no doubt that for convenience of handling, repairs, and cleaning, the larger tubes are preferable, and if this diameter can be obtained without loss of efficiency, which appears to be the case, tubes of at least 3 in. or 3½ in. diameter should be more generally adopted by all makers.

A NEW BALANCED PISTON-VALVE AND ITS APPLICATION TO FOUR-CRANK ENGINES.*

By WILLIAM O'BRIEN (Member).

NOT many years ago the ordinary marine-engine was of the two-crank compound type, and it occupied comparatively little room on shipboard. With the introduction of the triple-expansion engine, the space required was greater; and, when the four-crank engine was adopted, a further encroachment on space was made for its accommodation. To minimise as far as possible the space occupied by the latter type of engine, as well as to reduce weight, the Clyde balanced piston-valve has been designed; and by its application to the four-crank engine the space taken up fore and aft will only be about the same as formerly required by the three-crank engine. The space thus saved may be utilised in war ships for the better equipment of magazines, etc., and in merchant vessels for cargo-carrying purposes or passenger accommodation as required.

---

* Read at a meeting of the Institution of Engineers and Shipbuilders in Scotland, January 23rd, 1900.

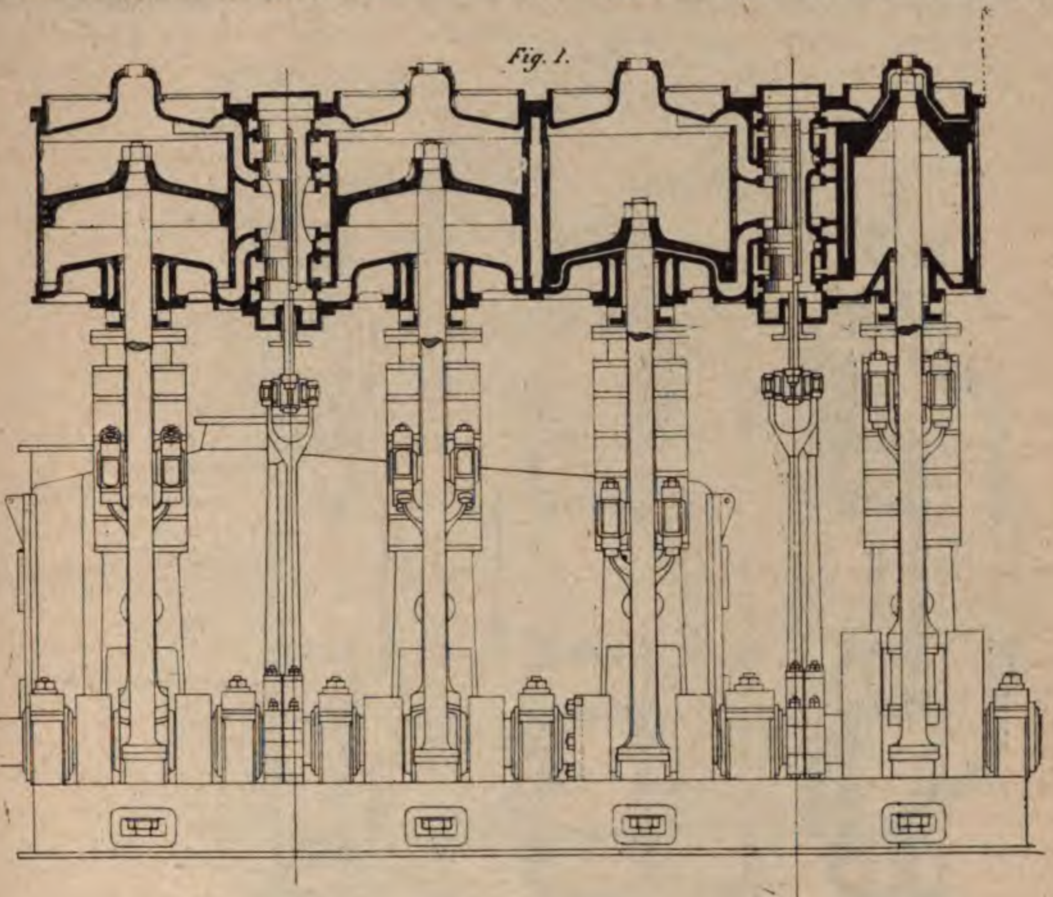


Fig. 1.

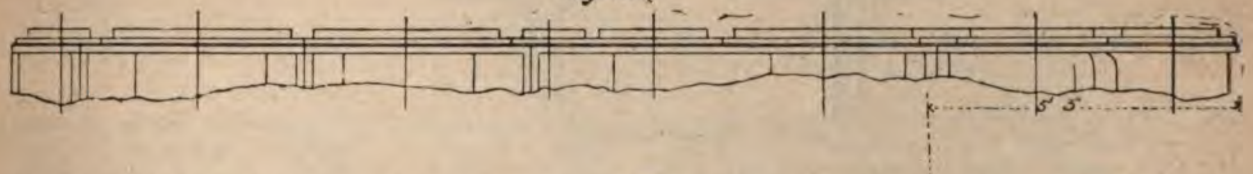
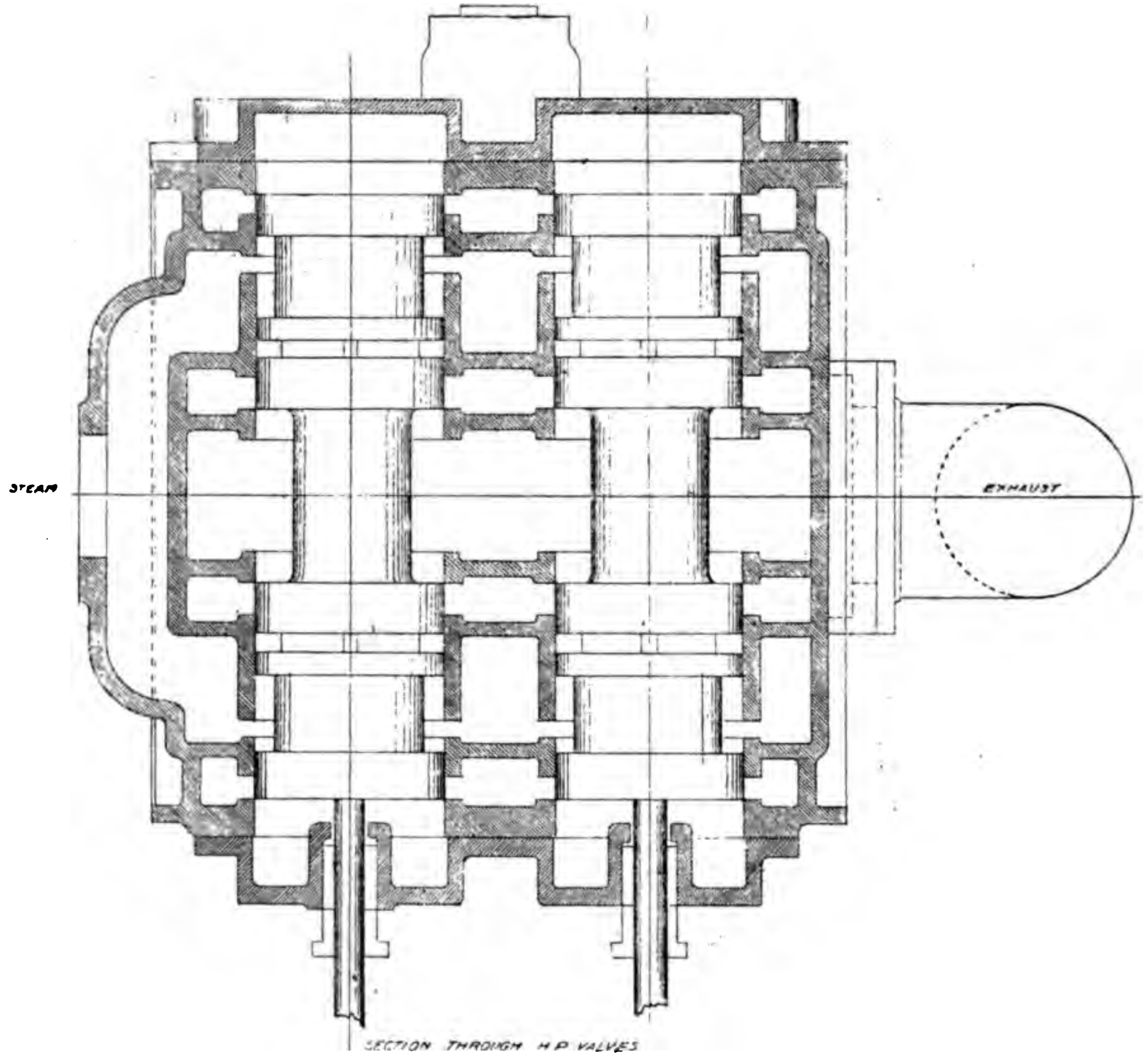


Fig. 2.

In Figs. 1 and 2, a comparison is made between an engine of the four-crank type, recently completed by an eminent engineering firm to indicate 2,500 H.P., with two piston-valves and two flat slide valves for the four cylinders, or one valve for each cylinder, and four sets of valve-gear, and an engine fitted with cylinders of the same dimensions to indicate the same H.P., having only two Clyde balanced piston-valves and two sets of valve-gear for the four cylinders. The latter engine is 5 ft. 3 in. shorter over all, and with fewer working parts than the former. There are only two sets of valve-gear against four sets, while the reversing shaft is only half the length required for the four sets of valve-gear. Some of the pipe connections between the receivers are dispensed with; the intermediate-pressure receiver pipe is done away with, saving about 11 ft. of 12-in. copper pipe: the low-pressure receiver pipe is 8 ft. long, thus saving about 2 ft. of 12-in. copper pipe; and the eduction pipe is only 4 ft. long, saving over 6 ft. of 15-in. pipe. With these reductions, and the amount of metal saved in designing the engine for the Clyde balanced piston-valve, the weight is considerably less. What might also be claimed as a very important feature, with engines designed for this type of valve, is the lessened number of joints; thus minimising the danger of leakage, saving workmanship, and reducing the cost of production. It will be seen from Fig. 2 that there is only one joint between the cylinders, which is not a steam joint: whereas in Fig. 1 there are four joints, two of the latter being steam joints and two not.

In the illustration showing the combined high-pressure and intermediate-pressure valves with five ports, the top and bottom ports take the boiler steam pressure into the high-pressure cylinder through the straight ports at the top and bottom of the cylinder. The exhaust steam from this cylinder passes over the top and bottom ends of the valve into the interior of the valve, and from there it passes through the ports on each side of the middle or exhaust port into the intermediate-pressure cylinder, through the curved ports leading to the top and bottom of the cylinder. The exhaust from the intermediate-pressure cylinder passes into the middle port of the valve, then into the receiver or connecting-pipe to the valve for the two low-pressure cylinders. This valve, which differs somewhat from the afore-mentioned valve on account of the steam pressure in the two cylinders being the same, has only three ports. The two end ports convey the steam from the intermediate-pressure receiver to the forward low-pressure cylinder, by the straight ports at the top and bottom of the cylinder; and the exhaust steam passes over the ends of the valve into its interior, thence to the exhaust or middle port of the valve, which is open to the condenser. The steam to the after low-pressure cylinder is admitted through the same two end ports of this valve, by the curved ports leading to the top and bottom of the cylinder; the exhaust from the cylinder passes into the middle port of the valve, and from there to the condenser.

Fig. 3.



SECTION THROUGH H P VALVES

From what has been said, and what is shown in the illustration, it will be apparent that the advantages gained for the same power by adopting the Clyde balanced piston-valve are saving in space, reduction in weight, and fewer working parts. Fig. 3 shows two high-pressure valves inside one casing, and Fig. 4 shows two low-pressure valves inside one casing. The subject appears to the writer to be of sufficient interest and importance to warrant his bringing it under the notice of the Institution; in fact, it seems to him to bid fair to cause some revolution in ship design, at least in the internal arrangements, by devoting the space saved to other purposes.

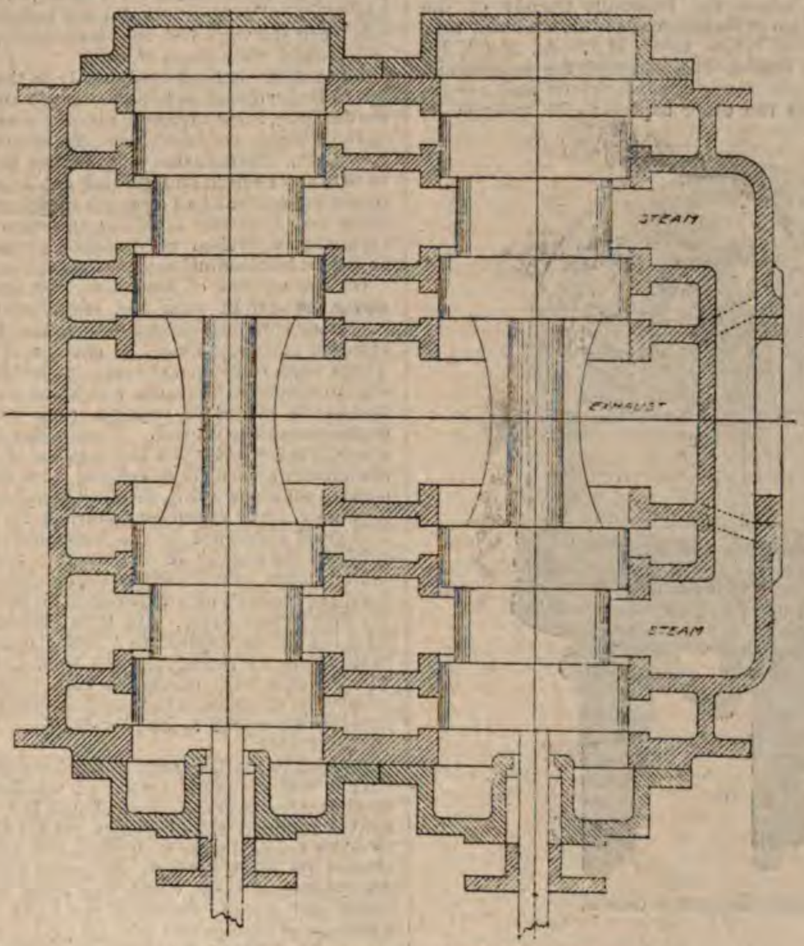
THE EDSON RECORDING GAUGE.

THE utility of a continuous graphic record of any phenomenon or function has been recognised now for many years, as is exemplified by recording barometers, gauges on water mains, and just lately continuous indicator for engines. The same principle has been employed for recording the course of a ship upon a continuous chart. The deductions and conclusions to be drawn from a record of absolute continuity are much more reliable and correct as a basis than any number of independent observations taken at specific intervals of time.

We have pleasure now in describing and illustrating the Edson Recording Gauge, which is being introduced into this country by Messrs. Findlay & Battle of 91, Queen Victoria Street, London, E.C. These gauges are made for steam, ammonia, air, gas, water, and other fluids, and can be used in any situation where a continuous record of pressure is desired to be made.

The instruments consist essentially of three distinct elements—viz., a device with a pencil or marker actuated by the pressure, a clockwork mechanism carrying and moving a chart, and an alarm device which will operate when the pressure gets outside a particular margin or range which can be pre-determined. The special feature of the Edson Gauge resides in the extreme simplicity of the recording device, which consists of a heavy steel diaphragm chamber, which, by its formation, admits of a certain flexure of the diaphragm under internal pressure. The diaphragm is of large diameter, having an area of 16 square inches, which enables it to record the slightest variation of pressure. By reason of its large diameter, the diaphragm is capable of considerable range of movement, sufficient to positively move the pencil or marker without the intervention of any gearing for multiplying motion.

Fig. 4.



SECTION THROUGH L.P. VALVE

A New Balanced Piston-Valve and its Application to Four-Crank Engines.

The instruments are fitted with high and low-pressure alarm-bells, either directly on the instrument or at a distance therefrom, by which an alarm is given when the pressure gets out of the range for which the instrument has been previously set.

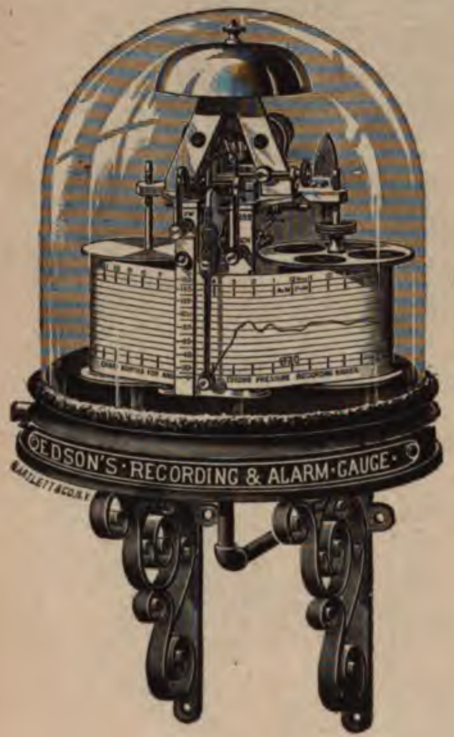
These gauges are now being used very extensively for marine work, and the Ashcroft Manufacturing Co., of New York, U.S.A., who are the makers, report that they have installed them on the steamships *New York* and *St. Paul*, of the American Line; and also on the steamship *Kaiser Wilhelm der Grosse*, of the North German Lloyd Steamship Co. They have recently been supplied to Messrs. Ludwig Loewe & Co. for their works in Berlin.

It will readily be seen that the presence of such a gauge is likely to conduce to careful firing and steady steaming of the boiler, as the chief engineer, who can have the instrument placed in his cabin, has under the immediate notice a continuous record of the pressure, covering the whole 24 hours, and quite independent of any officer or other person. From this he can note which watch gives bad results, and by noting the particular men on any particular duty he can readily find out which person or persons any particular phase of circumstances is due to.

A neat album is provided for filing the records away day by day, and, being numbered consecutively, they form a continuous record for future reference.

REPAIRS TO HULLS AND MACHINERY OF MODERN STEAMSHIPS.

THIS was the title of a paper, of considerable practical interest to shipowners, shipbuilders, repairers, and seagoing engineers, read before the Scientific Society of the Glasgow Technical College at its last meeting on the 13th ult., the author being Mr. John White Boyd, M.I.N.A., M.I.M.E., Glasgow. He began by stating that, although the commercial aspect of the subject was much too important and too inseparably connected with the other aspects to be ignored, he purposed confining himself to practical points, such as wear-and-tear and the means to obviate it, and the repairs rendered necessary by faulty construction or material. A detailed account of the various parts most subject to renewals and repairs would form altogether too lengthy a paper, and he would confine himself to items which were of the greatest importance and requiring most care and attention. He would treat of those items as were concerned, in turn, with ship's hulls, with ship machinery, and with boilers.



THE EDSON RECORDING GAUGE.

Proceeding to deal with hulls, the author first referred to water ballast tanks under the boilers, and said that of all the ballast compartments in a ship these were far the most liable to deterioration, and if not most carefully attended to by cleaning, scaling, and cement-washing, frequently, caused in time a great amount of trouble and expense. The great deterioration here was due principally to the heat from the boilers on the tank top plating, which affected floors, longitudinals, reverse frames, and intercostal angles, and was set up by sweating and contact with the heat of top plating. If tanks were always full of water, the same amount of waste would not take place; but as water-ballast was only carried at intervals, there would always be a certain amount of corrosion going on, especially as sufficient time was rarely allowed in port for examination. The ballast tanks under the holds did not suffer to the same extent, but in cargo steamers making voyages across the Atlantic in bad weather, and not sufficiently ballasted, the author said, the tank plating panted, or breathed, so much that the margin plate angles got started, and in many instances fractured from this cause, damaging cargo and giving a deal of trouble and expense. The coal bunker plating and stiffeners were another heavy item in a vessel's upkeep, especially about the lower portion of the plating and other parts where coal was almost always lodged. The giving way of these parts very rapidly was due in many cases to the condition of the coals when bunkering, and the action of the gases which arose from the various kinds of coals shipped in unsatisfactory condition. Coating the surfaces, of late years, with bitumastic enamel had proved very satisfactory, and when the work had been well done, there had been no signs of corrosion after years of use.

The author then referred shortly to the structural weaknesses apt to be developed in ordinary cargo steamers not foreseen by the designer, these involving expensive and careful remedy, such as the stiffening of deckhouses, doubling butts, bracketing bulkheads, &c. Repairs due to stranding and collision required to be skilfully devised and carried out in order to maintain the requisite continuity of strength in the general structure. The items most generally requiring attention were the cutting and repairing of broken or damaged main and reverse frames, stringers, longitudinal beams, tank floors, and intercostals.

On the subject of machinery repairs the author said that under the head of wear and tear would come all the repairs necessary through friction of moving parts, and those due to attrition of passing fluids, in steam and water pipes, cocks, &c. There were, of course, the repairs to injuries which were traceable to strains in working, and those due to stress of weather, and to the racing of engines, over which, the author said, engineers had no control. To any one who had been brought much into contact with the repairs of ship machinery it was abundantly evident that engines from different makers, doing exactly the same work, involved the shipowners in very much higher or lower expenses according to the particular maker. The great difference in the comparative cost of maintenance between the engines of the various makers might be due to faulty design, inferior materials, or unskilled workmanship, but from the author's own experience he inclined to attribute it to the first-named cause. He then defined what he considered were the points implied in "faulty design," and detailed the best means of remedying the wear and tear thereby caused. These means were concerned both with original design as to proportion of parts, selection of material, &c., and to the facilities which ought to be provided for attending the machinery whilst at work.

Repairs to shafting next engaged attention, the author saying that it was no great matter of wonder to practical marine engineers that a crank shaft should fail through being unduly bent or strained when bearings got out of line with each other, or when unequal wear took place, and when the hull of a vessel altered its shape through the action of the sea or of unequal distribution of cargo, which was often intensified by the flexibility and springy nature of the hulls themselves, which the tendency of the age was to build too light. Some shafts did, of course, break through bad forgings and others from fatigue, the material of the shaft being subjected to such extreme hard work as to crystallise it to such an extent that its vitality became exhausted and its failure imminent. Since the introduction of built crank shafts matters had greatly improved, as also since the extended use of white metal in main bearings and crank-pin journals. With such bearings there was less friction and tendency to heating, and engines, in fact, could be driven at top speed for any length of time without having any water on the bearings, a thing scarcely possible with shafts working in gun-metal.

Propeller or tail-end shafts were also, it was notorious, expensive items to shipowners and insurers, through fractures, badly fitted propellers, and corrosion when the shaft was exposed between the liners in the stern tube. All propeller shafts, in the author's opinion, should be lined with brass throughout, to protect them from the corrosive action of the sea-water augmented by the rotary motion of the shaft. This corrosion is such that propeller shafts have given way inside the stern tube, breaking the latter and damaging the hull in such a manner as has sometimes caused the foundering of the steamer. The author drew attention to the good effects of having a free circulation for lubricating purposes, and of bevelling the sharp corners of the end of brass liners where such did not cover the whole shaft. Cederval's method of protecting the tail shaft by means of a stuffing-box ring, fitted outside the stern-post bush, thus excluding sea-water altogether, and effecting lubrication by oil injected into the stern-tube was next referred to, the author declaring that this method, although as yet not much used, had such merits that, were it thoroughly known, he felt certain it would be universally adopted. The propeller boss should always be recessed the diameter of the outer brass sleeve and a careful fit made, so that it might be jointed thoroughly watertight. A good-fitting india-rubber ring made a very good joint, and the neglect of this most important part of the fitting allowed water to pass along the keyway, and thereby corrode the taper on shaft as well as the key. Many propeller shafts had to be removed from this cause. A very good and easily effected preventative was to bore a hole in the boss of the propeller, and thoroughly fill up the recess with tallow.

After some reference to thrust bearings as also being fruitful sources of trouble and expense, and asserting that in his opinion no part of the propelling machinery had been so much neglected, the author passed on to consider repairs to boilers and what chiefly necessitated them. Boiler repairs most frequently comprised renewals of furnaces, combustion chambers, and tubes, and the re-riveting and caulking of seams and butts in the bottom. Original designs might, as in the case of engines, be held partly responsible for excessive wear and tear, *e g.*, insufficient spaces for cleaning, unequal distribution of stays, and the placing of butts and seams in inaccessible places where they could not be attended to, and often where the workmen were unable, even when building, to make a substantial job. To bad workmanship might be attributed the renewal of rivets, paring, caulking, and patching, which continually went on in the case of some boilers. This, however, was gradually being reduced owing to the greater care now exercised in the selection of material and in the work put upon it during construction and to the more general use of drilled holes and a discontinuance of drifted holes. These influences, together with the mechanical appliances now in use by nearly all builders, tended to the production of first-class boilers.

Corrosion, the author thought, might be considered the most serious difficulty both shipowners and those in charge of marine boilers had to experience. It caused expense, delay, trouble, and danger, and decreased the efficiency of the boiler. Reduction of pressure and partial, if not entire, renewal of parts affected, generally followed severe pitting or corrosion. To prevent corrosion many methods had been tried, but the author thought that zinc, either in slabs or electrogens, had merits of its own which could not be disputed by the majority of engineers. The use of zinc in boilers was based on the fact that when two metals of dissimilar character were immersed in a liquid capable of chemically acting on one or both of them, and were at the same time connected together by means of a metallic connection, that metal which was most acted on became the corroded element. Zinc would, if thus used in sufficient quantity, give good results, but sometimes too much was expected from, say, four to six plates in a boiler of about 25 to 30 tons. If four times this quantity were used at first, and supplemented from time to time as it was rendered ineffective, it would be found that corrosion could be prevented.

Pitting in boilers was much more difficult to deal with, and from the author's own experience of electrogens, as patented and supplied by the Glasgow Patents Co., he found that they were most effective, both for pitting and general corrosion. Electrogens were balls of zinc, having a bar of copper through their middle as a conductor. A copper wire was fastened at each end of the copper bar, the other end of the wire being secured to the boiler structure where most convenient, preferably by a small pin, fitted into a tapped hole. The reasons why electrogens were not more in general use were: first the expense, and secondly the extra attention required to the fixing of wires; but, if shipowners were aware of the benefits of their use, they would adopt this method, which lengthened the life of a boiler, and saved a large expense under the head of wear and tear.

In concluding, the author said it was a fact that could not be disputed that when repairs became necessary they should be done in the most thorough and complete manner, because merely covering up defects in the easiest way possible cost in the end very much more to shipowners than was at all warranted or necessary. Where ships have efficient supervision, carried out on this principle, they prove most economical, not only in the matter of repairs, but in coals and stores. This was due a great deal to alterations and improvements made in the working parts, which designers could not foresee, and were only discoverable in actual practice.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

The Elder-Dempster Lines.

THE extraordinary development of the African Steamship Company and of its kindred associations is quite a characteristic of the times. At first the indefatigable head of the firm which manages the African Line seemed to be content with his achievement of practically absorbing the opposition British line to the West Coast of Africa. But he was only watching his opportunity for fresh departures. Soon the cargo boats of his lines were trading both to the United States and Canadian ports. Then all manner of kindred businesses were brought into play to develop the resources of the countries with which his lines trade. To assist the tourist traffic to the Canaries a comfortable and well-appointed hotel was established. To finance the business of the West Coast, banking facilities were afforded them. To develop the palm oil trade mills have been established at Liverpool. When the twin-screw service, in respect of which Messrs. Petersen, Tate & Company negotiated for so long with the Canadian Government, fell through, Messrs. Elder, Dempster & Company it was who bought the goodwill of the old Beaver Line and secured the Canadian mail contract, for which they are now building a special fleet, commencing with the double-screw steamship *Lake Erie*, recently completed by Messrs. Palmer's, of Jarrow, and now secured by the Government for the South African transport service. The old Shaw, Savill & Albion steamship *Arawa*, which formerly held the record both out and home in the New Zealand trade—records which still hold, for they have never been beaten—is now engaged in this Canadian mail service under the new name of *Lake Megantic*, which was given her on return from her recent trip to South Africa with troops. Now the Canadian mail service seems fairly in working trim, the West Indies have taken up Mr. A. L. Jones's attention, and he has entered into a contract with the Government to run new services in that direction for the purpose of making a market for the fruit products of those colonies, so as to save them from the distress into which they have fallen through the ruinous competition of bounty-fed beet with their cane sugar. His firm will get a substantial sum from the Government to aid it in the establishment of its new lines, and the effects cannot fail to be exceedingly serious for the old-established West India Royal Mail Steam Packet Company. Some of the colonials suggest that the financial assistance given to the Elder-Dempster Company should be taken from the amount now given to the older line. But even if that suggestion be not accepted, the entry of a new, energetic and powerful rival into the field is certain to make a very serious cut into the profits of the older concern.

Since the above lines were written I hear of yet another new departure on the part of Mr. Jones. It is an experiment in quite a new direction, but it is one which may be followed by other shipowners, if successful, and perhaps even by the Admiralty itself. Mr. Jones has purchased three coalpits in South Wales, and is thus in command of a private supply of about 300,000 tons of coal per annum for the use of his fleet. The results of this experiment, which eliminates all intermediate occupations and profits, will be watched with the greatest interest. If it prove a success, no doubt Mr. Jones's example will be largely copied, and a great revolution in the coal trade must necessarily follow any extensive development of the idea.

Messrs. C. W. Kellock & Company

sold the old Union liner *Arab* by auction at Liverpool on the 15th February. She fetched a good price—over 40s. a ton, her gross tonnage being, as I stated last month, 3,192 tons, and the price realised being £6,670. She is purchased by a London shipbreaker. Thus a very famous and favourite old passenger ship disappears from the lists of the fleets.

Another Disappearance

is that of the old Cunarder *Gallia*, which on the 12th February, left Liverpool for a French shipbreaker's yard. The fact that she has gone in this way bears out the wisdom of the judge who tried the insurance case arising out of her stranding. He held that she was a constructive total loss, and the event has shown that he was right in fact as well as in law, for no one could be found who would treat her as anything else, so to a foreign scrap heap she must go. She dates from about the same period as the *Arab*, but unlike the old Union liner, she still retains her original boilers and has never had her engines tripled.

Towing Barges at Sea.

The practice of carrying coal down the East Coast in strings of barges has, as many of my readers know, already become a very important traffic, and from what one hears of American practice it is very likely to be still further extended in our own waters. It is curious to see that in France an outcry is being raised against the practice, and that by shipowners. They allege that this mode of transit should not be permitted. They do not, however, base their case upon the only ground which in this country would be likely to give them a hearing, viz., on the assertion that the practice is one fraught with danger either to the men who are sent out in charge of the barges or to the public who use the highways of the sea. Such suggestions, if there were sufficient facts to be adduced in support of them—which I do not for a moment suggest—would afford ground for some inquiry, at least, by our authorities. But in France things are done very differently. The shipowners take the ground that the competition of such craft is unfair to shipowners, because the barges can shift cargo at lower rates than they themselves could, or at least do move it. They conveniently add that there is an injustice to seamen also in the practice in that those who man the barges are not, as seamen are, liable to conscription for service in the national navy. But the real point of the grievance is the too great cheapness of transit which it threatens to bring about, a point which in this country would be considered the highest testimony to its value.

A Correction.

Last month in speaking of the loss of the *Merrimac* I gave the master as Captain Purcell. In that I was wrong. Captain Purcell was in charge of the ship when she last sailed from the United Kingdom. But, as will be remembered, the ship was stranded in Canadian waters, and as a result the court of inquiry suspended the master's certificate, whereby he had to surrender the command of his vessel. This was, at the time, considered a hard matter, but little outcry was made about it, for severe views as to the responsibilities of shipmasters have been the rule of late with Canadian courts of inquiry. In the event the matter has been in every way advantageous to Captain Purcell. In the first place he escaped drowning, and in the next he was afforded sufficient leisure to enable him to study for and pass the examination for his extra master's certificate, and thus to give himself further qualifications for command. In point of fact, the officer who had charge of the *Merrimac* at the time of her disappearance was Captain Davies.

A Converted Steamer.

The *May Flint*, now a four-masted barque on the American register, was formerly the well-known Transatlantic liner, *Persian Monarch*, which, when she took the famous elephant Jumbo from the Thames to New York, was perhaps the most discussed vessel of her day. After stranding on the American coast some years ago, she was converted into a sailing vessel and Americanised. In her new career she has proved herself a fairly good sea boat, though she has made long passages and now makes her appearance—and not for the first time—on the overdue list. On the 13th November she sailed from Hong Kong to Tacoma, and, not being reported, caused some anxiety towards the end of January, when reinsurances were effected at five guineas. Since then the rate has risen to twenty guineas. The vessel in question was built in 1880 by Messrs. A. McMillan & Company, of Dumbarton, and was in her day fairly big even for a steamer. She was especially noted for the height of her 'tween decks. In this connection it may be mentioned that Messrs. Flint, who owned her amongst their fleet of nearly a dozen big sailing vessels, were reported in November to have sold her—with the rest of their fleet—for about £100,000 to San Francisco owners for trade in the Pacific Ocean. Messrs. Flint themselves, following the lead of many other shipowners, are turning their attention to steam, and are having a fleet of four large steamers constructed for the trade between New York and Honolulu.

The "Times" and the Transports.

The task of the *Times* representative at Southampton who has been down to describe the departure of the transports for South Africa has not been an altogether enviable one. The sight of a single transport departing is no doubt a soul-stirring spectacle, and the occasion, of course, will bear reasonable repetition. But when it comes not only to seeing it, but to writing about it, day after day, and week after week, the necessary repetition of detail must become very trying when a certain amount of copy has to be provided as to each successive event. This to a certain extent must be the correspondent's excuse, but that he needs something of the kind is evident from the style of his recent remarks. As instances of what he has been reduced to we may take his comments on the departure of the *Pinemore*. These appeared in the issue of the 16th February and the greater part of his space is devoted to an account of how he was "assaulted by a door," which, impelled by a gust of wind, "knocked him flat on his back, to say nothing of other things." This, if perhaps a somewhat uninteresting private detail concerning a member of the fourth estate whom nobody knows and few perhaps care about, has the merit of doing no one any harm and of possibly being accurate. The same defence cannot be urged in respect of this correspondent's observations printed in the *Times* of the 9th February in regard to the comparative merits of the *Majestic* and the *Briton*. He there says, "the *Majestic* was beaten out of sight by the *Briton*, and promptly the theory was floated that she had been ordered to proceed under her speed. It was a false rumour, a fictitious explanation." The *Briton* did indeed make a faster passage out than did the *Majestic*. But I can see no other word of truth in the allegations here quoted. Ere ever the *Majestic* left Liverpool it was known that her orders were that she was—as is the fact, in spite of all that is said and so peristently repeated by the *Times* writer—to proceed out at reduced speed. The vessel in fact left Liverpool on the 13th (wrongly printed as the 18th in my notes) of December. Through the exigences of Christmastide my notes for the January issue of this column had to be sent in before the holidays. I wrote therefore long before (by arriving at Capetown on the 30th December) she completed her outward voyage. Yet I distinctly assured my readers that a fast passage was not to be looked for from her, and gave several weighty reasons why it would be so. These reasons were not and could not have been, as the *Times* writer suggests, an after thought faked up for the purpose of excusing an unexpected collapse. They laid bare conditions which I asserted to prevail and which, as the event showed, did in fact not only exist, but actually had the result I said they would have. Let the *Times* correspondent remember one fact, which is noted from time to time in his own journal. Some ships go out as "freight ships," and some as numbered transports. The *Briton* belongs to the former class, the *Majestic* to the latter. It will be found that the freight ships, of which the control and management are retained by their owners, make passages with troops on board as passengers such as they normally make, because they are under normal conditions. The numbered transports are no longer under their owners' control, but are loaded and sailed under the orders of the Admiralty, and their passages are very often abnormally long because the conditions which the Admiralty impose upon them are abnormal. It would be well if those who know little, and have to pick up what is told them, would refrain from imputations of the kind I have now pilloried and especially from unworthy and unfounded suggestions of motive.

The Castle-Union Amalgamation.

The last day of February, 1900, sees the extinction of the old Union Company. Founded in 1855 as a steam collier company, it is now absorbed by the more virile Castle Company, which for so many years was its keen, and, perhaps at first, its despised rival. As we have seen, the capital of the two companies was practically equal, though it was divided into ordinary stock and debentures in different proportions in each concern. New debentures and new stock of the Castle Company will be issued to wipe out the Union shares and other liabilities. The new company starts with a great fleet, worth some four millions sterling, according to the books, and probably of a great deal more value at the price of shipping to-day. The interests of the employés of the Union Company have been carefully safe guarded. The shareholders in the older concern have any protection they may claim by the addition of Sir Francis Evans to the Board of the Castle Company, and also by the admission of this gentleman (who has proved himself so able a chairman) to the firm of Messrs. Donald Currie & Company, who will manage the new company. But their real safeguard is the fact that they entrust their interests to the man who created the Castle Line, and who has proved himself so well able to manage the affairs of a big and constantly growing adventure. Economies will, and must be effected by so great a consolidation of interests, and the united mail company will be in a position so strong that it must be well able to cope even with the access of business which the close of the present South African War must bring. It will therefore be well able to ward off any attempts of any possible opposition to cut into their trade. Great changes in detail will follow, possibly, in due course, but it is to-day too early to attempt to forecast their nature. Even Sir Donald himself will probably not yet be in a position to see the full results of his own successful negotiations. It should be chronicled, however, that the shareholders of both companies welcomed the amalgamation with satisfaction and that the only question that could be raised was one of the purest detail, namely, as to how the rights of the holders of fully and half paid shares in the Union Company ought to be mutually arranged. This was settled by counsel, and eventually accepted by those affected, though the principles which guided their advisers in their opinion was not quite grasped generally.

The London, Brighton, and South Coast Railway

has issued a well-illustrated and interesting little pamphlet under the title of the "Riviera and Italy for a Ten Pound Note." It shows how tickets for a sixty-day visit to the South of France, and to that part of Italy which lies between Ventimiglia and Genoa, can be obtained for the modest sum named. The Brighton Company's route to France is one of which the popularity is rapidly increasing as the public learn to appreciate its advantages. The points in its favour are numerous indeed. In the first place the boats it provides are comfortable, fast, and seaworthy, which is something to say, considering the class of boats found on some of the shorter routes, where speed alone is the attraction to be offered. Again the country which one reaches when the steamer is left teems with historical and architectural interest, whilst it is not quite so much in the beaten track as some other parts of Western France.

The Transport Service,

thanks to the immense resources of the British Mercantile Marine, goes on with great speed and with wonderfully few hitches. The only casualty of any kind to be reported this month is the loss of a propeller-blade by the s.s. *Pinemore*, of the Johnston fleet, between Southampton and Queenstown in the heavy February gale. This matter, though not of much consequence in itself, necessitated a putting into the Mersey for repairs, and thus entailed considerable delay to the troops on board. But the long procession of transports, which started in October, still makes its way to the South, though some of those which form units in it, like a stage crowd, are making their appearance more than once in its ranks. Hardly a day passes but there is at least one departure. It is a very unusual thing to find a day when there is not at least one arrival reported from Cape Town. Several important ships have been taken recently. The Cunard Line have lent their *Sylvania* for the transport of mules from the United States, a work in which her sister, the *Carinthia*, has already made a couple of successful voyages. The White Star *Afric* of the Australian line, on her regular voyage, took out a large contingent of Imperial Yeomanry, including the contingent of the Duke of Lancaster's Own Hussars. The Orient Company has had its steamship *Austral* chartered. This, it may be noted, is not the *Austral's* first visit to the Cape. She has been there in her regular service for her owners at the time when they did not use the Suez Canal, but took the long sea route. Thus it came about that for many years the *Austral* held, if not the Cape record, at least the best steaming time between British ports and the island of Madeira. The new Dominion liner *Norseman* and the just completed Beaver liner *Lake Erie* have each started during the month, whilst the number of vessels belonging to the Castle and Union Lines that have been dispatched has been very remarkable. Much credit is due to the staffs of each line for the great expedition with which their ships have been turned round, as well in South Africa as at home ports.

The "Patria."

At the end of January I had an opportunity of inspecting the wreck of this steamship off Deal. She lies with her head pointing down channel on an even keel, and without the smallest suggestion of a list. The fury of the fire is very well evidenced by the condition of her upper works, of which one has a good view, as at low tide her decks are just awash. Right aft the deck beams have been evidently melted, and the decks have fallen in. The two after-masts are down, and everything is burnt out of the houses. There seems to be no hope or intention of raising her. However, her cargo comprised a good deal of copper, and the Whitstable divers, who have undertaken operations upon her, are chiefly concerned to get out this valuable metallic freight. The work, they seem to think, will last beyond the present summer, and then the wreck is to be dispersed.

Alleged Tampering with the Mails.

What looked at first like a repetition of the notorious Jago case came before the Southampton magistrates a few days ago, when an officer of one of the American liners was charged with improperly dealing with certain negotiable securities. But on a further hearing explanations were forthcoming and the case was dismissed. Rather a curious point to notice in this matter was the fact that the magistrates seemed to have no jurisdiction in the case, for the *St. Louis* is an American ship, and the alleged offence, if it took place at all, happened on the high seas. Thus no court, save one of the United States itself, would be competent to deal with the charge. This matter is one which may well be regarded by marine engineers. There have been cases of late where foreign courts have attempted to take cognizance of charges in regard to offences said to have been committed by British officers aboard British ships on the high seas. It is quite certain that no foreign court, of criminal jurisdiction at least, has any right to touch charges in regard to what happened on the high seas under the red ensign, and any persons charged in this way should appeal to the court on the point, and, if necessary, call in the aid of the British consul.

The Norddeutscher Lloyd

announce that their twin-screw mail steamship *Kaiserin Maria Theresa*, which sustained such unfortunate damage on her trial trip in May, 1899, is to start on her first trip for New York from Bremen on the 13th of March. She is making her renewed trials at the time I write. The company will thus have a fine companion for the *Kaiser Wilhelm der Grosse* ready for service in ample time to get the cream of the traffic for the Paris Exhibition.

The Evoy Patent Adjustment Compass

has recently been on view in Victoria Street. The invention which is now being brought forward is not by any means a new one. It has seen much practical work. It has thus stood the test of experience for long periods of time, whilst it has won encomiums from the commanders of at least two vessels in the American Line, to say nothing of other navigators. The local attraction of the steel in a steamship has ever been a source of difficulty and danger to navigators, who are upset in their calculations by the varying deviation of their standard compasses. Various devices have been tried to get over the difficulty. The Allan Line, for example, make one mast of wood, and place their compass on it. Other lines have elevated tripods to bear their compasses. These are, however, not only unsatisfactory, but very expensive expedients. The present invention has the merit of cheapness combined with efficiency. The compass, which is designed to stand rough usage, is run up to the jumper stay between two of the vessel's masts, and is thus kept clear of all her attraction. When it is desired to take a reading, the card is locked by an ingenious and simple device, and the compass lowered to the deck for comparison with the steering-compass. The recent developments in the patent have been chiefly in matters of detail. But it is attention to detail which spells success in such matters, and from what I have heard and seen Mr. Evoy's patent is likely to be found in the future in most well found vessels.

Anti-Attrition Metal.—In consequence of the steady increase in the sale of anti-attrition metal on the North-East Coast, the company, who have their head offices and works at Emerson Street, Southwark, London, S.E., inform us that they have appointed Mr. John S. Barr, of 16 and 18, Broad Chare, Newcastle-on-Tyne, as their sole agent for the Tyne and Tees.

THE FUTURE DEVELOPMENT OF THE STEAM ENGINE.

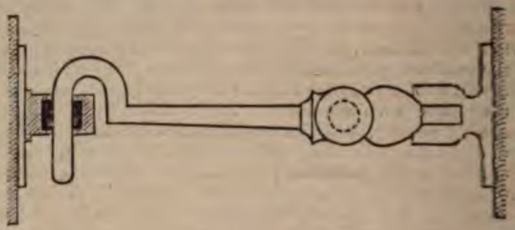
MR. ALFRED SAXON, M.I.Mech.E., read an interesting paper before the Manchester Association of Engineers, last month, on "The future development of the steam engine." After reviewing the principal features of development in the past, Mr. Saxon proceeded to consider the probabilities of the new century in reference to the direction of progress. With regard to pressures, he remarked, these would be as high as the materials and construction of the boilers would admit. He had no doubt that with a revolution in boiler construction, which they might confidently expect, standard pressures would rise to 500 lbs., and probably even higher. With higher pressures the system of expansive working would be more utilised, but must be subject to certain limits as to the number of cylinders employed. Probably it would not be found necessary to go beyond quadruple expansion. As to engine speeds, the double-acting vertical type of engine, with forced lubrication, had opened up great possibilities; and, although there was a limit to the velocity of the reciprocating parts, this did not seem to have been reached as yet, and he had not the slightest doubt that in stationary land practice they would be able to approach the high speed of 15,000 ft. per minute. As to economy, the probabilities of the new century in this respect seemed to be to reduce the steam consumption to about 8 lbs., and the coal per I.H.P. per hour down to 1 lb., or even to $\frac{3}{4}$ lb. of the best fuel burned under the most efficient conditions, in the newest and best types of boiler plant. He predicted that engine-makers in the new century would make a great point of standardising and classifying their engine designs, and that suitable units of power would be adopted to meet the varied demands, and that only compound, triple and quadruple expansion engines of the best type would be used. Simplicity in the valves and valve gear seemed to be a lesson which the steam turbine taught the reciprocating-engine builder, and in this respect a diminution of cost and wear and tear would probably be arrived at without interfering with the economy of the steam engine, although the governing cylinder would still of necessity retain valves and valve gear for the measurement and control of the steam to be admitted for work to be done during each stroke; still, he ventured to forecast the abolition of the valves and valve gear of the succeeding cylinder or cylinders.

In the discussion on the paper, Dr. Nicholson said with regard to the lines on which economy was obtainable, he and a colleague had made a series of experiments that brought out some points which, although not yet fully confirmed, ought, if true, to be more widely known. One particular point they discovered was that the leak of steam past valves from the steam chest into the exhaust without going into the cylinder was much more extensive and important than was perhaps usually imagined. In a high-speed 60-H.P. engine of American type, with automatic cut-off, they actually measured an amount of leak of 300 lbs. per hour, and inferred a much larger leak, of five to six hundred pounds, when the engine was running under normal conditions. They found that this leak occurred in the form of water across the valve face. Now the leakage would be diminished if that formation of water could be prevented, and any leakage thus be made to occur in the form of steam. The inference was that if they could heat the valve face, or superheat the steam, they would destroy that method of leaking, *i.e.*, that in the form of water, and it was to this fact that many of the economies in connection with steam engines were due rather than to causes commonly assigned. At the Manchester Technical School, where they were equipping large laboratories for research, they were going to have a large compound steam engine specially fitted for testing this very point of leakage in connection with three types of valves, viz., the slide, the Corliss, and the Sulzer.

The "Niji," a 31-knot torpedo boat destroyer, built for the Japanese Government, by Messrs. Yarrow & Co., left the West India Docks on February 7th for Greenhithe, where she remained for the adjustment of compasses, and on Sunday she left for Japan. That day had been specially selected by the Japanese authorities, as it is the anniversary of the accession to the throne of the present Japanese dynasty 2,560 years ago, which has thus been unbroken since B.C. 660. The present Emperor is the 121st of his race.

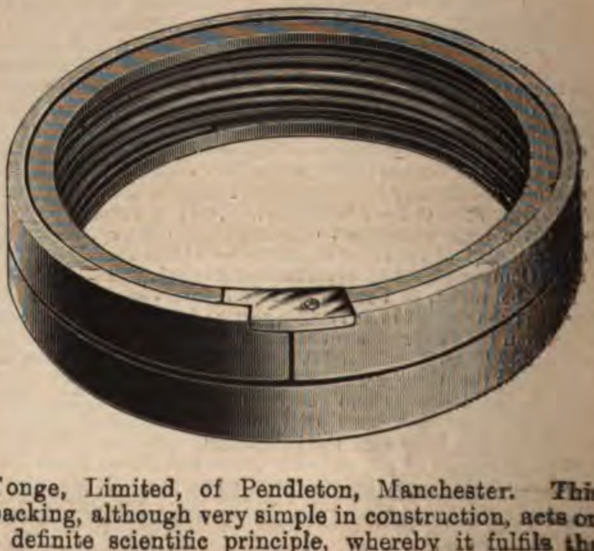
AN IMPROVED DOOR HOOK AND EYE.

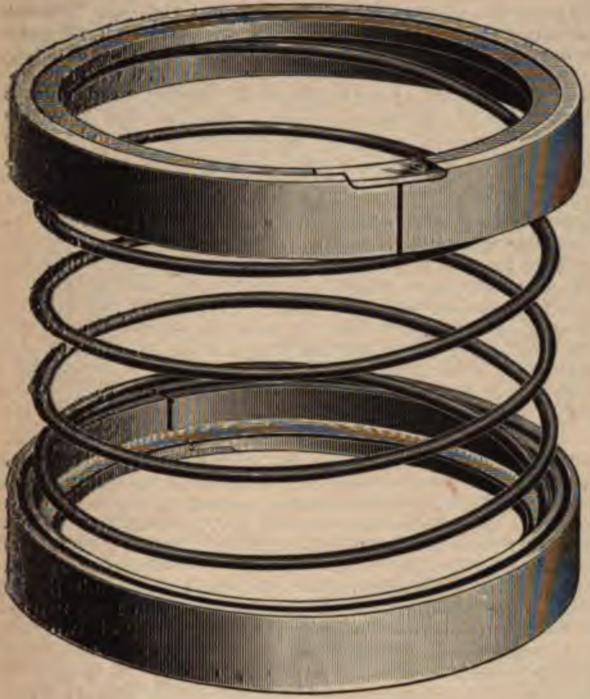
AN improved hook and eye for use on ships' cabin-doors and alley-doors, known as Taylor's patent noiseless hook and eye, is shown in the accompanying diagram. It was the invention of the late Mr. Taylor, the Liverpool agent for Messrs. George Maclellan & Co., of the Glasgow Rubber Works, Maryhill, Glasgow. The principal feature of the appliance consists in the use of a rubber-band, which may be inserted in a groove in the eye, or slipped over the beak of the hook. In either case the hook will be held so firmly through the introduction of the rubber that vibration is prevented, and the old inconvenience in connection with the securing of doors on board ship disappears. At the knuckle end the hook is double-jointed to admit of a rotary movement. This hook is being used on steamers built by Messrs. Harland & Wolff, Denny Brothers, Raylton Dixon & Co., and other companies, and is said to have proved an effective remedy for the jarring of ships' doors, which has been such an annoyance in the past. The hook and eye may practically be had of any size, and of brass or white metal.

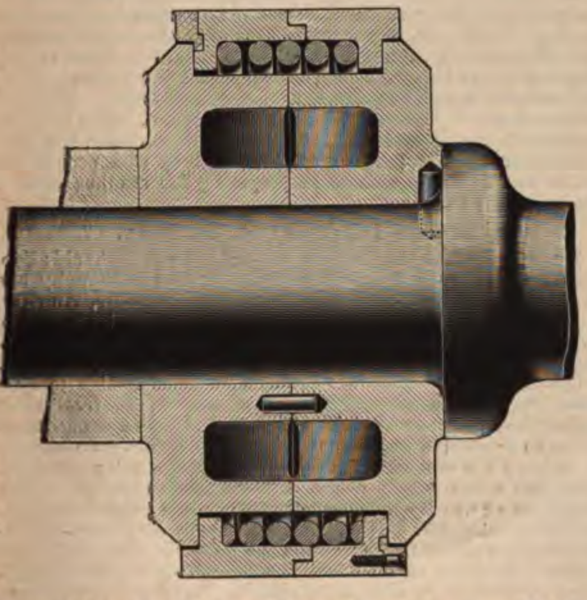


AN IMPROVED PISTON-VALVE PACKING.

THE accompanying illustrations show the latest form of the "Lancaster" patent piston-valve packing, which is made by Messrs. Lancaster & Tonge, Limited, of Pendleton, Manchester. This packing, although very simple in construction, acts on a definite scientific principle, whereby it fulfils the







two necessary conditions of being practically frictionless, and, at the same time, steamtight. As will be seen from Figs. 1 and 2, it consists of two plain cast-iron rings and one spring only. By giving the latter six or more coils inside the rings a great amount of coil-friction is set up between the spring and the rings similar to that caused when a rope is lapped several times round a capstan. This coil-friction renders it impossible to collapse the rings by any sudden pressure on the outside, such as takes place when the rings are working over parts, even if the spring is made only just strong enough to hold the rings to the sides of the valve-chest or barrel. In practice it is found that a resistance to collapse of over 200 lbs. per square inch can be combined with an active pressure of less than 2 lbs. per square inch. This ratio is sufficient for all practical purposes, and if care is taken in fitting the rings to the valve no trouble is found in working after the rings get thoroughly bedded to the barrel, and there is less wear and tear than with any other form of valve. Fig. 3 shows half of a piston-valve fitted with the "Lancaster" patent packing as working in the high-pressure valve-chest of a compound locomotive, large numbers having been supplied for this purpose to some of the principal railway companies and locomotive engineers. Hundreds of the packings are also at work in stationary engines from $1\frac{1}{2}$ in. to 26 in. diameter of valve, and their sale is rapidly increasing.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondents at home and abroad.)

To Raise the "Maine."

IT seems that the plan suggested to the United States Government recently for the purpose of raising the ill-fated battleship *Maine* is not to be adopted after all. The idea in question was worked out by Captain Alexander McDougall, the inventor of the whaleback type of vessel, who proposed to send to Havanna a fleet of ten or more of the whaleback steamers in service on the great lakes. These vessels are of peculiar construction and light draught; some of the tow barges drawing only $3\frac{1}{2}$ ft. without cargo, and 3,000-ton steamers only 10 ft. aft with nothing in the extreme bow, so that their mean draught would be about 5 ft. The vessels have, of course, a very large water ballast capacity to be used when required, and are loaded down to full 18 ft. in carrying ore, although they are themselves of only 22 ft. depth in some cases. The manner in which a tow barge is made to lift the stern of a steamer is as follows: the forward compartment of the consort or tow barge is filled with water, and chains, fastened to the stern of the steamer, are hove taut with windlass. Then the water is pumped to after compartments of the consort, resulting in a leverage being secured the full length of the vessel (300 ft.), so that 400 tons is thus raised on a draught of $7\frac{1}{2}$ ft. On arrival at the scene of the wreck, divers with electric drills would make holes in the bilges or sides of the *Maine*, say four in each place and about five inches apart; into these holes a steel casting shaped like a hand, with the fingers open and bent, would be placed. In the palm of this steel hand there would be a large hole to engage the shackle of the chain attachments that would be made on both sides of the wreck to the bows of as many whalebacks as would be required to make the lift. Only a short lift would be made with each effort, but it was Captain McDougall's idea that the wreck could in this way be gradually worked into very shallow water.

The Rearmament of Old Warships.

Although it is beginning to be felt that the great contest between guns and armour which commenced in 1864 is at present somewhat in favour of the former, yet it is only with the very latest types of guns and projectiles that the armour of to-day can be overcome. Yet there are at the present time many warships in the British Navy which have a muzzle-loading armament, and the uselessness of these guns at fairly long range is demonstrated by Captain Eardley Wilmot, R.N., in an article in a contemporary journal. Against one of these battleships armed with muzzle-loaders, says Captain Wilmot, a moderate-sized cruiser with 6-in. quick-firing guns could attack the other with impunity, keeping out of range by superior speed, and riddling all her unarmoured parts. He also thinks that it is a mistake to suppose that the old ordnance in broadside ironclads cannot be replaced by guns of modern type as well as with turret ships. The Austrian ironclad *Tegetthoff* is pointed to as an example of how an old warship can be improved and brought up to date. This vessel of 7.500 tons was launched in 1878, and completely refitted a few years ago with new machinery, twin-screws—involving considerable structural changes—and a new armament at a cost of £150,000. If this is all the money spent upon such alterations as are here mentioned, it would be as well for the Admiralty to send some of our obsolete battleships to the firm which made the alteration, at the same rate of pay, and we should thus obtain very cheaply a fleet of vessels capable of taking their place in the fighting line instead of being mere encumbrances to the dockyards. Some of our old ironclads are, of course, not worth rearming, and to include them in the effective list only deceives the country.

Portsmouth Dockyard.

The shipbreakers are now at work on the new Royal yacht, and Vice-Admiral Fullerton attends the yard almost daily and keeps a sharp eye on all that is being done in the way of alteration. The vessel will probably be ready for her trials some time next autumn, but more probably will not. However, 100 shipwrights of this yard have been set to work upon the vessel, although they could not easily be spared, and it is to be hoped that they will very shortly put the vessel to rights. A great number of the men who are at present working on the Royal yacht ought to have been turned on to the new armoured cruiser *Kent*, which has just made a start upon No. 5 slip. Men have been busy in the workshops preparing material for the *Kent* for some months past, and she would have been formally commenced much earlier if the slip had been ready for her. It was hoped some time ago that the *Kent* would be launched this side of Christmas, but that is now impossible, as it cannot be said when the new Royal yacht will cease troubling the yard, and the completion of the *London* and *Formidable* must not be delayed. The *Kent* is to be 440 ft. in length, and will displace 9,800 tons. She will have an I.H.P. of 22,000, and her armament will consist of 14 guns, including a twin 6-in., mounting one gun forward, and one aft, to work in a barbette, similar to the 12-in. gun on a battleship. The new Japanese battleship *Asahi* is to be docked here before she goes on her trials. In this connection it may be mentioned that the officers of the Japanese vessels which go into dock at this yard are generally permitted to wander at will over the various naval establishments.

The Navy League and our Naval Requirements.

The Navy League is apparently seriously alarmed by the formidable projected naval programmes of Germany, Russia, France, &c., and has accordingly dispatched a circular to the Press throughout the country dealing with our naval requirements. The circular commences with the stereotyped statement that, whatever the cost, the British Fleet should be able to meet and beat the combined sea-forces of any two Powers, to afford protection to our commerce, and prevent serious interruption of the food supplies and raw material upon which our existence depends. We must be strong enough, says the Navy League, to paralyse the efforts of hostile fleets by confining them to their ports, and to maintain a force of cruisers sufficient to guard the ocean highways against commerce destroyers. Our margin of superiority in battleships is insufficient, in the opinion of the Navy League, to do this, and it is pointed out that, if the lists of our battleships be examined, amongst the 53 completed battleships named in the latest Parliamentary Return will be found 16, varying from 20 to 35 years of age, deficient in speed, armed with obsolete muzzle-loading guns, and full of inflammable wooden fittings. On the other hand, no mention is made of the number of foreign battleships which are in a similar, and perhaps, worse condition; and there is not much doubt that the Continental Powers have more obsolete warships in their Navy Lists than this country has. The number and value of our cruisers completed and under construction are dealt with in the circular, and the conclusion of the Executive Committee of the Navy League is that we are still deficient in this important element of naval strength. There is no doubt that if the demands of the Navy League were acceded to by the Government, we should have a very efficient fleet, but unfortunately the expense has to be considered.

The Navy and the Army.

The proposed increase of the Army, which necessitates the spending of so much money, has made the critics apprehensive lest our efforts to maintain our supremacy afloat should in any way be relaxed on account of this expenditure. Several passages in Mr. Goschen's speech on the amendment to the Address have been quoted in support of the theory that the Navy is to be neglected, or partly so, and that the policy adopted will be that of robbing Peter to pay Paul, the former representing the Navy and the latter the Army. For instance, Mr. Goschen said in one part of his speech that Mr. Wyndham and Lord Lansdowne were elaborating plans which it was believed would place the country in the necessary state of defence, and that "we are working at those plans, and with the Navy *as it is* and those preparations, the country need entertain no feelings of insecurity." The words "as it is" have been taken by some critics as meaning that the Navy is to be allowed to weaken in order to provide for deficiencies of the Army, a policy, it is pointed out, which may easily be carried to a point which would endanger the efficiency of the former arm. Mr. Goschen also used the unfortunate words "coast defence," and these have been immediately taken up as the text on which to hang numerous homilies on the evils of spending money on fortifications which can always be laid out to better advantage on the Navy. It is well known that the Navy has already suffered more than the Army in order that huge sums should be laid out in coast defence—which is, after all, only subsidiary to the defence provided by a fleet in being. However, it is to be hoped that the fears entertained by the critics will prove to be unfounded.

Devonport Dockyard.

Some most important orders for work have been given to the Keyham factory, and the Admiralty seem to be highly pleased with the efficient and economical manner in which the orders for machinery have been carried out. The boiler shop in particular has been fortunate in obtaining orders for important Government work, for it has secured the first order for each new type of water-tube boiler for which the Admiralty has secured the patentee's rights. There are now in hand two sets of Normand boilers intended for the reboilering of two first-class torpedo boats, and a complete set of the ordinary marine type is being built for the turret ship *Hecate.* It is probable, however, that these boilers will never reach their at present intended destination; for it is likely that after all this vessel will not be reboilered and refitted as was originally intended, and the £10,500 allowed for her refit will go towards wiping off the excesses on other items of work in the refitting programme. The smithery department at this yard also deserves to be commended for the good work it has performed. It appears that the order for catheads, davits, and other large forgings for the *Implacable* was so well executed that similar orders for the *Bulwark* and *Montagu* have since been entrusted to the local staff. The old, obsolete cruisers *Carysfort*, *Constance*, *Conquest*, and *Shannon*, and the turret ship *Prince Albert* have at last departed from this yard, but there are still many other vessels whose room would be preferable to their company. The refit of the *Amphion* is already well advanced, and, what with her being dismantled aloft, and stripped between decks, she little resembles the smart vessel which put into this port a few weeks back. She is said to be preparing for another term of service in the Pacific.

Wireless Telegraphy for the Navy.

Experiments are shortly to be carried out which should afford valuable results in connection with wireless telegraphy and communication between vessels at sea and the shore. An effort is to be made to send messages to or from a ship by means of a captive balloon ashore. It is possible, however, that messages may be taken in from a ship at sea without having resource to a balloon at all, but it would seem to be desirable to have something of the kind if messages are to be freely and expeditiously sent to the fleet whilst at sea. The experiments are to be conducted by Lieutenant Arnold-Forster. The Marconi is perhaps the best known system of wireless telegraphy, but there are others which are said to be as good, if not better, nearly all of which are being tested by order of the authorities at Whitehall. Mr. H. W. Sullivan, the well-known marine electrician, has invented a new marine relay, which is being used by the Admiralty, and is declared to have been found to possess superior advantages over other relays. The Admiralty, in fact, are prosecuting their enquiries and experiments in connection with wireless telegraphy with a good deal of vigour. It may be mentioned here that Signor G. Marconi in his recent lecture on "Wireless Telegraphy" at the Royal Institution said that the experiments had shown that wireless telegraphy was reliable and certain in operation. He hoped before long that the necessary funds would be found to enable Trinity House to establish communication all round the coast with lightships and lighthouses, by means of which a vast amount of property and many lives might be saved.

The German Shipbuilding Programme.

The new Navy Bill which has been presented to the German Reichstag, and approved of by the members of the Federal Council, warns us that if the proposals are carried into effect we shall before long have another naval rival who will have to be seriously considered. Germany proposes to almost double her fleet, and, whether for offence or defence, intends building up a navy which will eventually be equal to that of France or Russia, and have to be taken into account when the Navy Estimates of this country are under consideration. There are, it seems, to be two double squadrons, composed of 34 battleships, including two flagships, with 8 large and 24 small cruisers and 80 torpedo boats. There is also to be a reserve of one battleship for every squadron, and one torpedo boat for every division, in case vessels should be lost or disabled. But these squadrons will not be ready for sea until 1917, and it is estimated that before that time 17 battleships, 39 cruisers, and 12 divisions of torpedo boats will have become obsolete, amongst which will be some of the newest vessels in the German Navy at the present moment, and a few cruisers which have not yet had their keels laid. As the various warships become obsolete others are to be laid down to take their place, a work which is to be quite independent of the proposed increase. Between now and the year 1917, 11 battleships, 8 large and 16 small cruisers, and four divisions of torpedo boats are to be constructed, and the present strength of the German fleet is to be maintained in addition. The *personnel* is also to be augmented until, by the year 1920, when the last of the contemplated ships should have been launched, the total addition will have been 35,551. The Bill, however, has not yet been passed by the German Parliament.

Chatham Dockyard.

Rumours are already current regarding the programme of ship-construction for the ensuing financial year. It is believed that the Estimates will include the laying down at this yard of a new battleship of the *Albemarle* type, and a new cruiser of the *Diadem* type, the battleships *Hood* and *Ramillies* also undergoing extensive repairs. The new battleship will probably be laid down on the slip vacated by the *Albemarle* early in July. Overtime is being resorted to freely in an effort to complete the programme of work at this yard by the time specified, but it is extremely unlikely that this will be the case. The cruisers *Grafton* and *Hawke* will certainly be completed before the end of March, but the completion of the *Imperieuse* and *Immortalite* has perforce been postponed. This is not because there is any lack of hands, for there are more men on the books at present than ever before, and nearly £13,000 per week are being paid in wages. The new battleship *Albemarle* has at present 500 shipwrights at work upon her, all of whom are working overtime in order to forward her construction as much as possible before the end of the present financial year. Although she was only commenced six weeks ago, she has made wonderful progress. The *Venerable* has now received her machinery, and her completion is to be advanced as far as possible by the end of the present month. A great number of men are working overtime on her with this end in view. The *Sappho* will soon be ready for active service, but no date has yet been fixed for hoisting the pennant or for her departure for the East Indies.

The Value of Smokeless Coal to the Navy.

It was reported a week or so back that a Cardiff firm had contracted to supply a foreign Power with nearly half-a-million tons of smokeless coal, but inquiry has only elicited the fact that no confirmation of this deal can be obtained. No sooner had the report appeared, however, than the chairman of the Executive Committee of the Navy League appealed both to Members of Parliament and the public generally to press upon the Government the necessity of taking steps to prevent large quantities of stores so essential to the efficiency of the fleet from passing out of the country into the hands of possible enemies. Smokeless coal, says Mr. Trower, is the breath of Empire. There is no substitute. Its use confers on the admiral of a fleet possessing it advantages over a fleet compelled to use smoky coal only comparable to the relative advantages of smokeless powder over the ordinary black variety. Except the Pocohontas coal measures in Virginia, there is virtually no other source of supply outside Great Britain. The practical monopoly of smokeless coal which would be obtained by our fleets if its sale were forbidden under the supreme law that governs wise nations and commonsense men is a prospective reinforcement of our national strength in time of war too obvious to need comment. There is also a want of proper colliers and supply vessels in the British fleet, a want that ought to be remedied at the earliest possible moment. It is to be hoped that the Government will have no hesitation in prohibiting the exportation of smokeless coal in time of war with a rival naval Power, and that they will at once restrict the export of this coal to foreign countries.

The New Royal Yacht.

Some radical alterations will after all be necessary before the new Royal yacht is ready for Her Majesty's use. It is declared by correspondents who have seen her that she will never be all that she was intended to be, and that on her voyage round to Portsmouth, with 550 tons of ballast in her, she was drawing two feet more of water than was intended, and altogether some important defects have yet to be put right. In the House of Commons Mr. Goschen said that until fresh calculations, which are in progress, have been made of all the weights that have still to go into the ship, it is impossible to say exactly what the extent of the error in estimate was, or what alterations will be necessary to ensure satisfactory conditions of stability, but they will probably include the shortening of the masts and funnels, the removal of a large quantity of silicate cotton which was introduced between the cabin bulkheads and in other places for the sake of deadening sound, and the removal of the greater part of the forecastle. The cost of repairing the damage to the yacht is to be kept quite separate from the amount laid down in the Estimates. The trouble with the *Victoria and Albert* has led to a demand in certain quarters for a committee on ship designs in the same way as there is at present a committee on machinery designs. The latter consists of the Engineer-in-Chief, his immediate assistant at the Admiralty, and the chief inspectors of machinery in the dockyard reserves. Sir John Durston is responsible to the Admiralty, and takes the credit for success or blame for failure. A committee on ship designs, composed of officers with a practical scientific knowledge, would be of great help to Sir William White.

Sheerness Dockyard.

The most important happening at this yard during the past month was the float-out of the sloops *Shearwater* and *Vestal*. The vessels were christened respectively by Lady Bowden-Smith and Miss G. Bowden-Smith, the wife and daughter of the commander-in-chief. The vessels were laid in February of last year, and are sister sloops to the *Condor* and *Rosario*. The engines for the *Vestal* were constructed at Keyham factory, where her Belleville boilers are being completed in readiness for delivery. The *Shearwater* was engined by the Thames Shipbuilding Co. The trials of both the *Condor* and *Rosario* are being run with much success, both the 30 hours' test at 300 H.P. and the 30 hours' run at 1,000 H.P. being accomplished without difficulty. The *Rosario* is to be ready for commissioning by the 19th of this month, and the *Condor* very shortly afterwards. On the 22nd of this month the *Basilisk* leaves for the South-East Coast of America Station to take the place of the *Beagle*, which has just paid off at this yard. Amongst the vessels which have just completed their refit is the *Circe*, which is to leave for Harwich to take the place of the *Onyx*. The *Gleaner* is in hand here, and the repairs to her will not be completed for a week or so. The *Trent* is to be paid off after a long term of service as gunnery tender here, and the *Spey* is to take her place. The latter vessel is receiving a new armament, including two 4·7-in. guns.

The Trials of the "Highflyer" and "Minerva."

Some particularly interesting and instructive steam trials have been carried out between the cruisers *Highflyer* and *Minerva*, to test the coal consumption of their respective sets of water-tube boilers. The *Minerva* is fitted with a Scotch type of boiler, and is supposed to have a H.P. of 9,600 and a speed of 19·5 knots, whilst the *Highflyer* is fitted with water-tube boilers of the Belleville type, which are supposed to give her an I.H.P. of 10,000 and a speed of 20·5 knots. Both ships are of 5,600 tons displacement. In the trials in question, it is reported that the *Highflyer* burned about 25 per cent. more fuel than did the *Minerva*, and in this connection a few extracts from a letter written to the *Globe* may be interesting. The writer, it is stated, is not on either of the two ships, but is biassed in favour of the Scotch boiler. According to this correspondent, in the first three runs the vessels steamed at ten knots for 60 hours each trial. For these three trials the *Minerva* burned for all purposes 258 tons, whilst the *Highflyer* consumed 328 tons, or 70 tons, equal to 27 per cent., more than the *Minerva*. In illustration of this we will suppose that both ships are filled with coal to 1,100 tons: then when the *Minerva* has burned 866 tons, the *Highflyer's* bunkers would be empty; but the *Minerva* would have 234 tons left, which would take her 1,638 miles, for at this speed she steams seven knots per ton of coals. After these trials the *Minerva* was ready to go at any speed as soon as the tubes and the furnaces were cleaned—no defects of any sort. But the *Highflyer*, with something like 100 steam joints to make, required five days and as many artificers as could be spared from the fleet, in addition to her own. The next trials were two of 60 hours each at 14 knots. Here the *Minerva* burned 380 tons, and the *Highflyer* 463 tons, or 83 tons in excess, nearly 22 per cent more than her competitor. Here again the *Minerva*, after cleaning tubes and furnaces, was ready to "toe the line," but there was the same sad story to relate of the *Highflyer*, the same signal from the senior officer, "How many artificers can you spare for the *Highflyer?*" and six days afterwards she was again ready for the contest of two trials of 60 hours each at 17 knots. Result: *Minerva* burned 613 tons for 98 hours, and the *Highflyer* 663 tons, or 50 tons more than *Minerva*. The remaining trials are two of 30 hours each at the highest speed that can be maintained, and two of 12 hours each at the highest speed that can be maintained. In one of these trials each ship will have one-third of her boilers alight only when the order for full speed is given. And lastly, two trials at the highest speed that can be maintained for 12 hours, the ships having previously been going at a slow speed for anything between 18 and 36 hours, the *Minerva* with one-third of her boilers alight and the remainder banked, whilst the *Highflyer* would have her remaining fires laid, and rely on the special feature of the Belleville boiler to raise steam rapidly.

The Treatment of Students at Keyham.

There have lately appeared in the Press several letters dealing with the treatment meted out by the Admiralty to the engineer students at the training college at Keyham, which is said to be in marked contrast to that accorded to the *Britannia* training school for naval cadets. It is admitted by all that the engineer officers of the Navy are in no way behindhand in patriotic sentiment, but this opinion will be considerably lessened if the engineers continue to accept the responsibility for many of the ill-timed and ill-considered letters which appear in the daily Press under various *noms-de-plume;* the writer in some cases asserting that he is speaking with the authority and sanction of the naval engineering profession. A correspondent writing to the *Globe* complains that it is nothing short of a scandal that an officer of commander's rank is considered good enough to be placed in charge of such an important establishment as the Royal Naval Engineering College. "The important duty of training engineers for the Navy," says the writer, "is surely worthy to claim the energies of an officer of post-captain's rank, and he should be assisted by an inspector of machinery." It is good policy to ask for more than you expect to get or need, and the *Globe's* correspondent cannot be accused of being too modest in his demands. The letter concludes by stating that "the scant attention which the Royal Naval Engineering College at present receives from the authorities is having a very bad effect on the character and attainments of the students, tending to make them lose all pride and zeal in their profession, even before their course there is completed; in addition to which the quality of the candidates for admission, both socially and intellectually, is being injuriously affected. Seeing that the training of an engineer officer costs the country only £86, as against £400 for the naval executive, if the reforms called for caused a slightly additional burden on the country it is one that could be well borne."

Pembroke Dockyard.

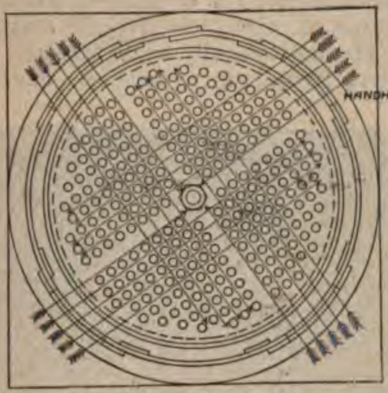
A strenuous effort is to be made to launch the new cruiser *Drake* in October next, and the *Essex* by the end of the coming financial year. The *Spartiate* is still completing, and the authorities have declined to allow any additional overtime being worked upon her. She will probably leave this yard for Portsmouth in May or June. She has been afloat in the harbour since October 27th, 1898. The water test of her boilers is to take place in about a week's time. The new armoured cruiser *Essex*, laid down on the 1st of January last, is making rapid progress. The slip on which she is being built is being extended, but the extension consists of nothing more than piles driven into the mud outside the slip, a line of balks being securely bolted down longitudinally over the top of each tier of piles.

Naval Guns for Field Service.

From news to hand from South Africa it is now certain that several 6-in. naval quick-firing guns have been mounted on carriages designed by Captain Percy Scott and sent to the front. The question was asked in Parliament whether the naval guns which have been sent up with the various naval brigades were taken from the ships on the Cape Station. Mr. Goschen in reply said that this was not the case and that the guns were taken from the stores at Simon's Town, although the carriages were designed, and many of them made, on board some of the vessels on the station. The 6-in. quick-firer which Captain Percy Scott has adapted to the purposes of field warfare is a little difficult to recognise on its improvised and most ingeniously constructed carriage. It is 21 ft. in length, throws a 100-lb. shell, and weighs seven tons. A mounting for the 6-in. guns is also said to have been designed by the experimental staff at Whale Island, which can be employed in armoured trains, or even on temporary rails. When these guns are sent to the front on their field mountings, our gunners will be able to throw 100-lb. shells into the Boer camp from at least 1,000 yards out of range of the Boer guns. Our deficiency both in the quality and quantity of field guns would have been very seriously felt if it had not been for the naval guns. Those both with Roberts and Buller are doing excellent service, and the same may be said of those seamen with their guns who were unfortunately locked up in Ladysmith. In a letter written by a bandsman at the front describing the engagement at Colenso, he says "had it not been for the navy guns we should certainly all have been massacred." Similar tributes to the efficiency and usefulness of the naval brigades have come from all parts of the theatre of war.

SIMPSON STRICKLAND & CO., DARTMOUTH AND TEDDINGTON.

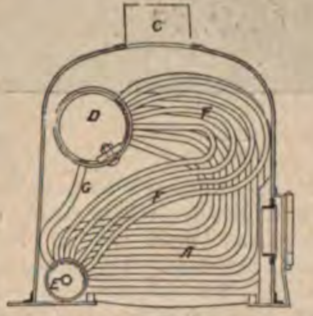
THIS firm has specialised the machinery of the high-speed launch until they have attained the remarkable performance of 18½ miles an hour with a boat only 40 ft. in length. They have specialised their Kingdon quadruple-expansion surface-condensing machinery, their triple-expansion four-cylinder engines, and the Strickland water-tube boiler until, with the high pressure of 300 lbs. per square inch, they can beat anything which is sent to race against them. In the way of launches and pleasure boats they have reached a very high standard. Amongst the types of boats they build are yacht's steam dinghy, launches; man-of-war's steam cutters. This latter is fitted with a teak awning for hot climates. Its dimensions are: length, 45 ft.; beam, 10 ft.; depth, 5 ft. 9 in. Its machinery is the H size Kingdon quadruple-expansion engine and horizontal return tube boiler with a working pressure of 175 lbs. When steaming it has a speed of 11 miles per hour. Of larger proportions is their steam yacht—length, 102 ft. in all, beam, 13 ft., and depth, 8 ft. 3 in. Her carvel is built with teak bottom, close copper and metal fastened throughout. She has forecastle, galley, and pantry; main cabin under the after deck, and four berths. Her machinery is the L size Kingdon patent quadruple-expansion engines and horizontal return tube boilers, with a pressure of 175 lbs. Her speed is 13 miles, but she can be made to go 14 miles an hour. They have also fitted their compound engines into a steam barge. One of these was 50 ft. long, 12 ft. beam, carrying 20 tons of cargo, the speed being 8½ miles an hour light. Another class of work is auxiliary machinery in sailing yachts. This machinery is intended to get the yacht along when the wind is down. One boat so fitted was 25 ft. in length by 8 ft. 6 in., and had compound engines, the total weight being 6 cwt, which gave her a speed of five miles. For colonial rivers stern-wheelers are much in requisition.



Plan of Vertical Boiler.

One of these, 24 ft. by 5 ft. 8 in. by 6 ft. draught, had a compound engine 2½ in. and 5 in. cylinders, with 7½ in. stroke with surface condenser, which gave her a speed of about six miles an hour.

As has been pointed out above their machinery has acquired a certain fame. Their Kingdon quadruple-expansion is well known. It consists of two pairs of tandem cylinders arranged on two cranks, the high-pressure and first intermediate pressure on the forward crank, and the second intermediate pressure and low-pressure on the aft crank. A single valve distributes the steam to each pair of cylinders, and there are no more working parts about the engine than are found in the ordinary compound type. By this arrangement no piston gland is subjected to the full pressure of the steam. This is almost the only quadruple engine the manufacture of which has been persisted in.

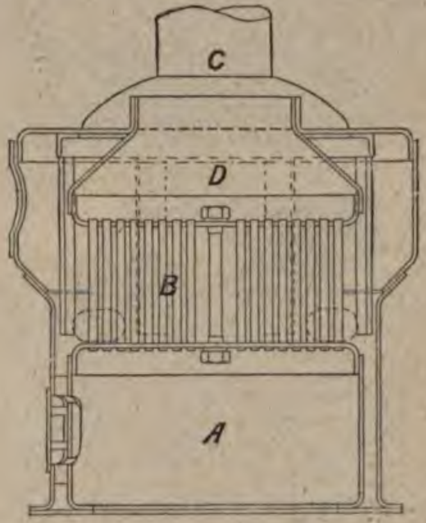


Strickland Water-Tube Boiler.

Their two-crank ordinary compo[illegible] done very satisfactory work. It has the [illegible] side the cylinder [illegible] pumps are d[illegible]

The compound, the triple, and the quadruple are condensing engines. The condenser is a solid-drawn copper tube of D section, placed outside the boat, the ends of which are fastened into suitable gun-metal castings passing through the skin of the boat. It is connected at one end with the exhaust pipe, and at the other end with the air-pump suction. A vacuum of 25 in. is easily maintained.

The boilers made by the firm for launch work are of three types—1st, the horizontal, with large combustion chamber and large furnace crown; 2nd, the vertical type, with water legs and vertical tubes leading from the furnace crown to the uptake; 3rd, the Strickland modification of the Thornycroft water-tube boiler for launches. The horizontal type consists of a cylindrical shell with a furnace at one end and a funnel at the other, horizontal tubes join the tube-plates. The great bulk of this type of boiler has caused it to be almost wholly discarded. Where, however, water is bad and the attendance very unskilled, it is the best boiler, as it can stand most ill usage. The second type is more used, as it is much less bulky. The smoke-box is inside the boiler, and the water-line is higher than the smoke box tube-plate. There is a large grate area, and high speed can be maintained even with natural draught. There is a large steam space, and this prevents priming. The third water-tube type is suitable for vessels which are intended for high speeds. It will be seen from the figure there are a steam-drum and a water-drum, and tubes joining them. The tubes, as in the ordinary Thornycroft boiler, lead into the steam-drum above the water-level. There are larger tubes, which are to the left and lead more straightly down to the water-drum, the tubes at the upper end joining into the bottom of the steam-drum. These tubes are the down carriers. The grate is under the small winding tubes, heats the water in them, and causes it to flow quickly into the steam space of the steam-drum. In some the tubes form the fire-bars.



Sectional Elevation of Vertical Boiler.

There was exhibited in the Yachting Exhibition at the Aquarium what appeared to be almost a toy engine, but which was powerful enough to force a vessel weighing 38 cwt., and of 30 ft. length, 6 ft. beam, and 3 ft. depth, through the water at a speed of 17 miles an hour. The vessel and machinery were constructed for a challenge contest at Oban. The vessel is of cedar. The engines are triple-expansion with four cylinders and four cranks; one pair of eccentrics actuate the valves of two cylinders next each other. There are thus two pair of cranks, a forward pair and an after pair, and the cranks of each pair are at 180 deg. to each other, whilst the forward pair are at 90 deg. to the aft pair. The piston speed is 750 ft. per minute at 1,100 revolutions, and the working pressure is 300 lbs. The cranks are carefully balanced, and the boat at full speed is wonderfully free from vibration. The bearings are made of phosphor bronze. The air pump is driven by a rocking beam. The boiler is the firm's own Thornycroft modified type, as shown in our illustration. Its outside dimensions are 5 ft. high and 4 ft. diam., and it makes easy steam for the engine at 300 lbs. per square inch. There is a fan driven by steel wire spring belts arranged inside the casing of the boiler, which provides the forced draught for the boiler. The circulating water for the condenser is supplied by scoops.

Boat 40 ft. x 6 ft. 5 x 5 Non-Condensing Engines.

The launch belongs to a yacht, and the race at Oban was against two other launches, one of which was fitted with engines of an older type built by the Dartmouth firm. The course was six miles in length, and the contract speed was 16½ miles. This speed she easily made, and, as mentioned above, on the race course she made 17 miles, or 14·75 knots per hour.

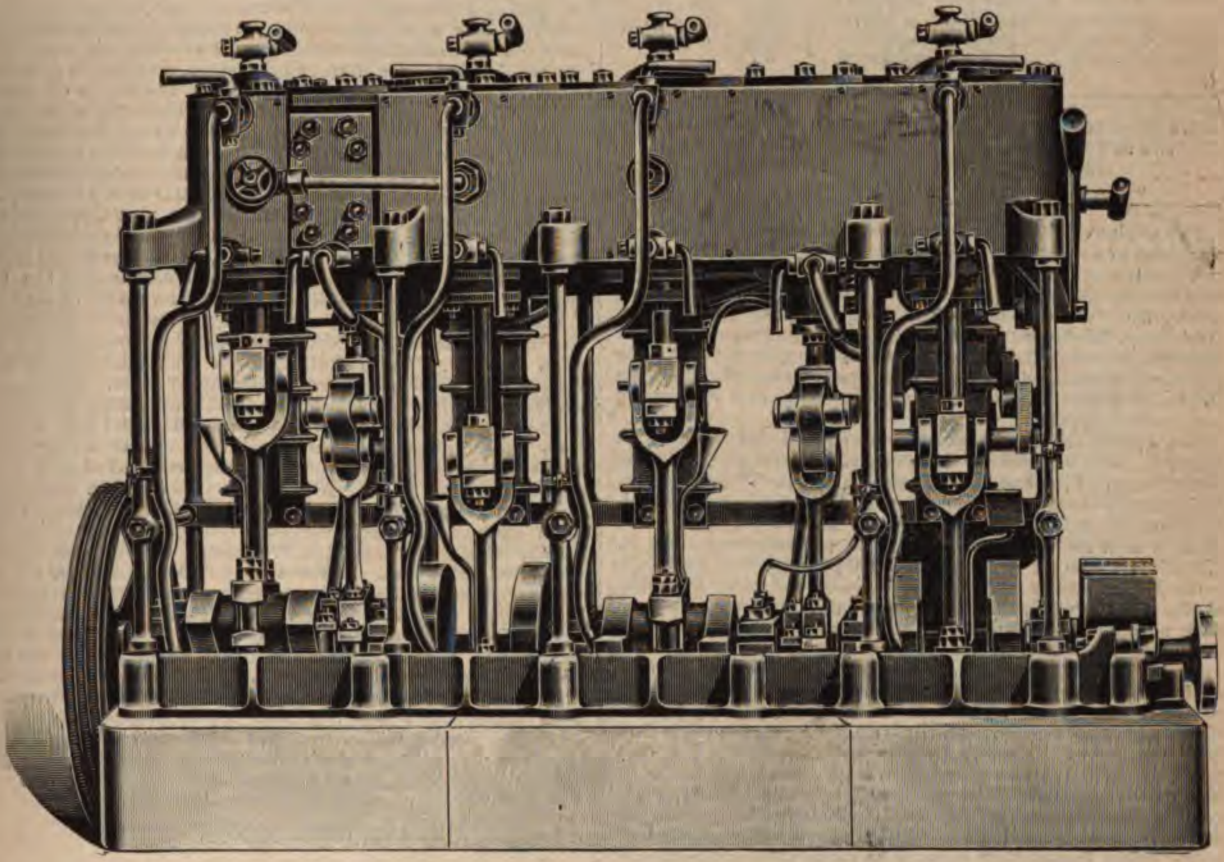
Messrs. Simpson Strickland & Co.'s, Limited, works at Dartmouth are situated on the east side of the river Dart, just above H.M.S. *Britannia*. The offices on Noss Point face the river, the steel and wood boat-building sheds being at the heads of two creeks. The boiler shops, foundry, smith and fitting shops are placed between the two boat-sheds with coppersmiths', galvanising, and general store contiguous. Most of the firm's work is of a special character, exceptionally high speeds or shallow draughts being what are most called for; consequently, a boat built by them is almost absolutely of their own manufacture, with, of course, the exception of some small fittings, and these are most usually made specially for them. The foundry, from long experience, can turn out intricate castings impossible to get elsewhere; whilst the boiler and fitting shops turn out machinery which weighs as little as 25 lbs. per I.H.P., in some cases even less. These weights, of course, can be lowered, but so far expense is prohibitive of such further reduction if uniform good working qualities are to be retained. It will easily be understood that it has taken years of careful and expensive experiment to reach the result obtained in so small a boat as Mr. N. B. Stewart's 30 ft. launch. Amongst its more ordinary work the company builds steam yachts, large cruising launches, &c., and has so far been particularly successful in this class; whilst its machinery has, by its economy, made its way, and found a market all over the world. We illustrate one of their launches moving at a speed of 18¼ miles per hour.

MARINE ENGINEERS' NOTES.

(From our own Correspondent.)

MR. ROBERTS and Mr. Taylor organised a most successful conversazione on January 31st, which was held at the Town Hall, Stratford. Many old and familiar faces were present, Alderman Kidd genial as usual, Mr. Laurie, Mr Leslie, Mr. Blelloch; indeed it was a strong turn out. Mr. Caird showed excellent slides in one of the dark rooms.

There have been fairly good results obtained in the experimental rooms by the Experimental Committee with a small feed heater. Mr. Laurie, Mr. McLaren, and Mr. Halliday have been busy with this now for some weeks. The trouble has been a want of sufficient steam with which to make the experiments, but Mr. Laurie, as usual, has come to the rescue in the matter, and is already looking about for a boiler of sufficient size and heating surface with which to provide steam for that experiment and others. As yet no progress has been made with the experiments on forced draught, but as soon as a fan has been obtained these will be proceeded with.



ENGINES OF MR. N. B. STEWART'S STEAM LAUNCH WHICH MADE 17 MILES AN HOUR AT OBAN.

There was a large meeting of members of the institute present at the discussion on Mr. J. F. Walliker's paper on Monday, February 12th. The council was well represented, and cards of invitation had been sent out to the members in town to draw a meeting. Mr. Shorey, the treasurer of the institute, was in the chair. The paper was read by Mr. Adamson. Its title was "Twenty Years of Progress in Cargo-Boat Machinery." Lloyd's Register informs us that the *Enterprise*, engined by Wilson, of London, in 1872, had a pressure at that early date of 150 lbs. to the square inch. The *Sexton*, engined by the Ousetown Engine Works of Newcastle-on-Tyne, in 1874, with a pressure of 120 lbs. per square inch, was triple-expansion, and had three cranks. The *Propontis*, engined in the same year by Messrs. Randolph & Elder, of Glasgow, was triple-expansion, and was fitted with Rowan's water-tube boilers. Mr. Perkins brought out his triples in the seventies, notable amongst them being the yacht *Isa*, with a boiler pressure of 120 lbs. The *Propontis'* boilers were not a success, because their joints gave trouble, and they had to be taken out. The boiler pressure of these water tube boilers was 90 lbs. Her present boilers are registered at 145 lbs. Dr. Kirk was very anxious during these years to obtain a boiler which would give him higher pressure, and they had to fall back on the Scotch boiler to provide them with these higher pressures after all. The author thinks the water-tube boilers for the tramp steamer is still in the future; they require delicate handling and a continuity of experience. Even the use of the evaporator so essential to the water-tube boiler can hardly be shewn to be of value to them. The introduction of the Siemens-Martin process for the manufacture of steel for ships and boilers, and Lloyd's rules regulating its testing and manipulation, gave confidence to the engineering world and hastened its adoption. Plates can now be had of five tons weight for boiler shells. Some it was said would last 30 years and it appears as if the prophecy would become true. In the attempt to get triple-engines to take up the same bed-plate space as the compound, some engineers placed the high-pressure cylinder on the top of the forward or aft engine. In other cases the third engine was attached in front of the bed-plate. The advantage of the three cranks being placed at equal angles to one another was easily seen. Mostly engines are fitted with double eccentric gear. Hawthorn, Leslie & Co.'s are fitted with Marshall's gear. These engines have 3,000 I.H.P. and pressure of steam of 160 lbs. They have been fitted with 21 cargo steamers. The five-crank engine designed by Mr. Mudd, is said to propel a vessel of 5,800 tons at 9 knots on 13½ tons of coal being at the rate of 1 lb. per I.H.P. per hour. In 1887 the average coal consumption was said to be 2·11 lbs. per I.H.P. per hour. In 1872 it was

1·828 and at present 1·5 lbs. The following table shows the pressure in 1879 and 1899:—

BOILER PRESSURE IN THE MERCANTILE MARINE IN TWENTY YEARS AS SHOWN IN "LLOYD'S REGISTER."

1879		1899
3·5 per cent.	Below 20 lb.	—
6·9 ,,	20 lb. to 30 lb.	—
4·2 ,,	30 ,, ,, 40 ,,	—
3·3 ,,	40 ,, ,, 50 ,,	—
3·3 ,,	50 ,, ,, 60 ,,	—
32·5 ,,	60 ,, ,, 70 ,,	·5 per cent.
36·1 ,,	70 ,, ,, 80 ,,	6·6 ,,
9·4 ,,	80 ,, ,, 90 ,,	12·3 ,,
·9 ,,	90 ,, ,, 100 ,,	4·2 ,,
—	100 ,, ,, 150 ,,	10·2 ,,
—	150 ,, ,, 165 ,,	45·2 ,,
—	165 ,, ,, 200 ,,	16·6 ,,
—	200 ,, and above	3·7 ,,
Five are recorded at 100 lb., two at 120 lb., one at 150 lb.		Over 5,000 steamers are registered with a pressure above 100 lb.

The work and skill of the engineer 20 years ago was nothing compared to what it is now. There were few steam-steering gears and hardly any forced draught arrangements. There are engines now for centrifugal pumps, feed pumps, auxiliary pumps, ash hoists, &c. There is now electric lighting and refrigerating machinery. There are two drawbacks—the propeller shaft and the steam pipes. There are few expansion glands fitted. He also thought better accommodation ought to be provided—the chief—he ought, at least, to have an office and a sleeping apartment separate.

The discussion on the paper was opened by Mr. W. C. Roberts. He referred to the statement about the splendid performance of the five-crank engine, which propelled a vessel of 5,800 tons at an average speed of 9 knots on 13½ tons of coal, being at the rate of 1 lb. of coal per I.H.P. per hour. Mr. Roberts said he had never come across a performance like it. It reminded him of a story of two old captains who met in a public-house, and in reply to a question by one as to the speed of the other's vessel, the other captain said, "About 9 knots an hour at sea, but about 12 knots in a public-house." The owners of the steamers who had to pay the coal he feared would not find quite so low a record. Mr. Basil Joy said that at Hull he had recently come across a tug which was 65 years old. She had had several new boilers and several new engines. Her present engines had been taken out of a trawler which had been wrecked off Margate, whilst her boiler was out of a trawler which had been wrecked off the Yorkshire Coast. A dent had been made in the bottom of the boiler by the rock, and she had been working with this indentation for years. In the early days of the triple-expansion engines the question of saving space fore-and-aft came to be of great importance, and the radial gear came in just at the right time, but with the new measurement regulations the same consideration did not apply. He was sure that engineers objected to radial gear because they did not understand it. Mr. Walliker thought there were two principal drawbacks of the engines of the present day — the screw shaft and the steam pipes. Mr. Joy would like to add a third-valve gear. In France the captain of a steamer had to pass through a very stiff course in engineering before he could obtain his proficiency certificate. If the captains of English steamers knew a little about the difficulties of engineers he would be more considerate. Mr. Lawrie said the author thought the spare time of the engineer had been greatly encroached upon, but in his engineering days, 20 years ago, he certainly had very little spare time and if the engineer of to-day had any less time for sleep and rest he must be very hard pushed indeed. The reason the author gave for the engineers of the present day being so hard worked was that there were so many auxiliary engines on board ship, but surely he did not mean that the auxiliary machines were continually breaking down. He believed that the engineer at sea had a very much better time than was the case 20 years ago when it was no uncommon thing for the engineer to remain below some two hours after his watch was done to get the water out of the stoke-hold and engine-room. He thought the passing of a master or mate in steam was little more than a farce. Nothing would cause more trouble on board ship than the state of things suggested. By the time that the ordinary engineer had complied with the new regulations of the Board of Trade for a chief engineer's certificate and properly learned his business he would want a little rest and feel inclined to leave navigation alone. Mr. W. H. Moss said the history of the *Propontis* should compel many of them to recognize what a remarkable man the late Dr. Kirk was. He had influenced marine engine practice and progress more than any other engineer from the early seventies right up to to-day. In addition to Dr. Kirk, Mr. Alexander Taylor, of Newcastle, and Mr. Seaton, of Hull, were both paving the way for the new type of engine, but the difficulty was a boiler. The engine had to wait for the boiler and the boiler for the steel makers. He had seen the Belleville at work on a long voyage in a Messageries Maritimes steamer, and he could not conceive how a competent marine engineer could be in doubt for a moment as to its inferiority to the cylindrical type. The water-tube boiler for marine purposes was wrong in principle. They wanted a boiler in which the fire, the source of power, could be efficiently controlled, and in which the water could adapt itself to its circumstances. In the cylindrical boiler the fire was taken care of; in the water-tube boiler the water was taken care of. Since the Ellis Eave's system of forced draught, the supply of air to the furnaces was better under control, the combustion more perfect. He understood that the consumption of coal with the five-crank engine in a whole year's average was 1·16 lbs. per I.H.P. per hour. Mr. Ruthven said it was notable that piston speeds had just doubled during the last twenty years. He would like to know if the 1·5 lb. of coal per I.H.P. per hour included the whole of the power developed on board. Mr. Hulme had done a good many journeys with Belleville, Yarrow, Thornycroft, Reed's and other water-tube boilers, and he was distinctly in favour of them. He thought engines should be so made that each of the pistons would have to travel at a speed corresponding somewhat to the flow of steam that was admitted into each particular cylinder. Mr. Moss spoke of the Inchmona being carefully arranged to give a low consumption per I.H.P. About three years ago Mr. Dalrymple discussed the question of coal consumption, and contended that on a basis of deadweight carried in proportion to coal burnt, a ship burning 1·24 lbs. per I.H.P. per hour was more economical than the Inchmona. It was a most serious question, for the owners of fast mail and ocean steamers, constantly exerting a high power, they had not reaped anything like the advantage from triple engines and high-pressures that the cargo-boat owner had. In fact, the anticipations of high speeds at sea at a moderate cost formed fifteen years ago had not been realised.

Members of the Institute will be interested to learn that Mrs. Shorey, the wife of the treasurer, wrote a beautiful hymn on the war, which was sung at the West Ham Church on the departure of an Essex contingent to the front. It was also received and acknowledged by the Queen.

GORDON'S SLIDING SCALES FOR SHIPBUILDERS, SHIPOWNERS, ENGINEERS, AND NAVAL ARCHITECTS.

THE sliding scales which bear the name of A. M. Gordon, devised for the ready and sufficiently accurate computation of the power necessary to drive vessels at a given speed, and also of the dimensions of vessels required to carry a given deadweight, are now very widely known and largely used throughout shipbuilding and shipping circles at home and abroad. Their author, Mr. A. M. Gordon, M.I.N.A., who until recently took a leading part in the management of Messrs. R. Napier & Sons' Shipyard, Govan, is now established in business as a consulting naval architect at Baltic Chambers, Wellington Street, Glasgow, and has just laid the shipping and shipbuilding world under further indebtedness through the devising and sale of a new sliding-scale concerned with the prompt determination of what amount of freeboard will be assigned by the Board of Trade (or other society empowered to act under their rules) to any vessel, having given dimensions of length, depth, and co-efficient of fineness.

In the two first-mentioned scales Mr. Gordon has put into the hands of those most deeply interested—and yet probably those not technically very deeply informed, viz., shipowners and their marine superintendents—a simple means of readily solving such problems as are concerned with dimensions, speed, I.H.P., displacement, and deadweight carrying capacity. Though probably few experts in naval architecture will at first be disposed to admit that any individual could invent a scale that would take into account all that is involved in determining the power required to propel a vessel at a given speed, it is abundantly evident from the wide acceptance accorded to the scales, that they take account of all that is essential for giving a very close approximation indeed to the results obtained in the actual speed-trials of ships. Besides affording a strikingly simple and rapid, they also give a nearer and truer estimate of power required in proposed vessels, than that arrived at by more painstaking, tedious, and costly methods. Many experts have only been convinced of the accuracy of the scales by actual test (which, it may be said, the author at all times invites). Yet nearly every shipbuilding and engineering firm at home and abroad, as well as a very large number of shipowning firms, marine superintendents, and consulting naval architects, now use the speed and deadweight scales. Some of the leading firms, indeed, have ordered as many as half-a-dozen scales, a fact which in itself forms the best testimonial possible to their worth and usefulness.

The new scale concerned with freeboard should commend itself, not only to shipbuilders, but also to all who have the formulating of new vessels. What more irksome task could be set an ordinary mortal than to take out from the Board of Trade tables — rules, explanations, and memoranda — the simple dimension of depth for a given length that a vessel would require to have in order to float at a given draught; or, in other words, to find what would be the assigned freeboard for a vessel of a certain length and depth? This is what the new instrument claims to rapidly make clear, and with the patronage that has been accorded the two former scales as a warrant of the accuracy and usefulness of this new one, we venture to prophecy for it wide adoption.

As to the use of these calculating scales in determining the dimensions of proposed vessels, an example may be given in order to show the great saving of time and the elimination of the chance of error, compared with the ordinary figuring methods. Say a plain cargo vessel is required, conforming to Lloyd's highest class, to carry a deadweight of 4,000 tons on a draught of 19 ft., and to steam, when so laden, 10 knots on the measured mile. Assuming that the vessel is to be built to a co-efficient of fineness of ·76: required the length, breadth and depth, also the I.H.P. to fulfil these conditions. The operator, taking *deadweight scale*, sets the co-efficient of ·76 against the required deadweight of 4,000 tons, and in sliding the moveable along the fixed part of scale, in the order clearly explained on the scale, finds the length and breadth most suitable for the particular trade that the vessel is to be engaged in—say 310 ft. length by 45 ft. breadth—the third dimension, viz., depth, say of 23 ft., being found against a speed of 10 knots. Now by reference to, and equally simple manipulation of, *freeboard scale*, it will be found that the freeboard required by the Board of Trade rules for these dimensions allows of the vessel loading to 19 ft., if she has a poop bridge and forecastle of a combined length of 125 ft., and from scale of displacement this vessel, having a co-efficient of fineness of ·76, will be found to represent a displacement of 5,760 tons. Then, from *speed scale*, the I.H.P. requisite to drive this vessel 10 knots on the mile will be found to be 1,120 I.H.P.

Circulars giving full particulars and prices of the several sliding scales can be obtained from the inventor, Mr. A. M. Gordon, Baltic Chambers, Wellington Street, Glasgow.

Institution of Naval Architects.—The annual meetings of this institution will take place on Wednesday, April 4th, and the two following days, in the hall of the Society of Arts, John Street, Adelphi, W.C. (by kind permission of the council). The Right Hon. the Earl of Hopetoun, G.C.M.G., president, will occupy the chair. The annual dinner will be given on Wednesday, April 4th, at the Grand Hall, Hotel Cecil, Strand, W.C., at 7.15 p.m.

OBITUARY.

THE LATE JAMES DEAS AND THE DEVELOPMENT OF THE CLYDE.

IN briefly alluding to the death of Mr. James Deas, the engineer-in-chief to the Clyde Trust, in the course of "Industrial and Trade Notes" last month, a promise was made to return to the subject and to give some account of the shart the deceased gentleman had taken in the development of the Clyde and its docks. He held the post of engineer to the Truse since 1869, and Glasgow Harbour, as it is to-day, is virtually the record of his service. Mr. Deas was the son of an engineer who belonged to Leslie, in Fifeshire, and his earliest professional training was obtained under his father on the Edinburgh and Dalkeith line. He was born in Broughty Ferry, however, and at the time of his death was approaching 73 years of age. His technical education was continued in the locomotive works of the Edinburgh and Glasgow Railway, and up till 1868 he served in the North British and the Glasgow and South-Western Companies, eventually succeeding his father as engineer-in chief of the North British Company. A year later he succeeded Mr. Andrew Duncan as engineer to the Clyde Trust.

Remarkable as has been the development of the navigation of the Clyde during the present century, the 30 years during which Mr. Deas was the resident engineer of the Trust, formed the period during which the greatest and most rapid advance was made. The record of the latter half of his working life is, as has been said, practically a narrative of the development of Glasgow Harbour. On Mr. Deas fell, in large measure, the responsibility of coping with the ever-increasing demand for dock accommodation. Not only had he to supervise the multitudinous details incidental to the upkeep of so vast an undertaking, but he had to initiate and supervise the various extension schemes which in almost unbroken succession have had to be undertaken. When he entered upon his duties the Trust was engaged in deepening the river, in constructing Queen's Dock, and in extending the quay space. These enterprises, successfully completed, were speedily followed by others.

Speaking at the annual dinner of the Clyde Trust officials in 1894, Mr. Deas related that in 1869 the quayage of the harbour was 5,604 yards, or 3·18 miles; the water area, 76 acres; and the gross revenue £150,000. To-day the quayage is 8½ miles, the annual revenue £410,000, and the water area 209 acres. And as to the depth of water, it has been increased since 1869 fully five feet throughout the 18 miles under the jurisdiction of the Clyde Trustees. More recently the deceased took part in the construction of Prince's tidal and graving docks—on the south side of the river—which were opened by H.R.H. the Duchess of York two or three years ago. These docks, which include one of the largest graving docks in the world—described by Sir William White as "a magnificent piece of work,"—are 81½ acres in extent. In connection with the various new works undertaken by him on the Clyde, Mr. Deas had recourse to a system, devised by himself, of using concrete instead of iron cylinders for the substructure of quay walls. Not only did the change result in a reduction of initial cost, but it was the proud boast of Mr. Deas that the three miles of quay wall so constructed had not cost the Clyde Trustees £100 for maintenance.

During the thirty years which Mr. Deas served the Trust the dredging plant was increased more than twofold in quantity, but above fourfold in efficiency, so that while in 1869 the total quantity dredged was 870,224 cubic yards, for the year ending 30th June, 1894, it amounted to 2,310,980 cubic yards, and the fleet of 22 steam barges conveyed the dredged material from the harbour and river to three miles seaward of Garroch Head, in the island of Bute, 46 miles from Glasgow. The river was deepened, widened, and straightened, including the removal of Elderslie Rock, at a cost of upwards of £70,000, so that groundings, which five-and-twenty years ago were of almost daily occurrence, are now about as rare as snow in summer; and the river was most effectively lighted by lighthouses and light towers, and by gas-lit buoys, defining the Channel from Dumbarton Rock to Port-Glasgow, so that the navigation of the river by night is as safe and easy as moving along the main thoroughfares of any great city. Dozens of steam and hydraulic cranes ranging from 30 cwt. to 130 tons were supplied for effectively and promptly dealing with cargo in all its infinite variety. Railways and sidings to the extent of

13 miles were laid along the quays on both sides of the harbour, and connected with the railway system of the kingdom.

Outside the affairs of the Clyde Trust and the development of Glasgow Harbour and dock accommodation, Mr. Deas' interests were but little exercised. Whilst not very actively identifying himself with the proceedings of the various professional institutions with which he was connected, he nevertheless in virtue of the remarkable development of the river and docks under his charge, was frequently called upon to deliver papers bearing on the subject before such bodies as the Institution of Civil Engineers, of Mechanical Engineers, and the Scottish Institution of Engineers and Shipbulilders, and his papers on the subject of the Clyde and its deveopment, forming part of the transactions of these bodies, are admirably full and informative.

ELECTRICAL NOTES.

(From our own Correspondent.)

Johnson & Phillips new integrating ampere metre is giving very good results, the accuracy claimed being 1 per cent. at all values of the current. The metre is driven by an electrically worked pendulum. The latter being so arranged that the impulse is received after the oscillations are less than a certain fixed amplitude. It works on the hit-and-miss principle like the regulator of a gas engine. The power absorbed by the mechanism not being above a watt. The metre itself is a fine iron wire, actuated by a solenoid, and this iron wire is attached to an aluminium pointer. Every 30 seconds the pointer is clamped, and the position of the pointer determines the angle through which the integrating mechanism moves. As soon as the integration for the 30 seconds has been completed the pointer is freed, and the current strength of the solenoid brings it into a new position depending on that. At the end of 30 seconds the same operation is performed. The instrument only requires $\frac{1}{200}$ of the maximum current flowing to start it.

The Frodingham Iron and Steel Co., Doncaster, like very many other engineering firms throughout the country have had an electrical plant installed for driving the machinery in their works. Electro-motors are arranged to drive the line rolls and skid, by means of worm-gearing running in oil. The speed reduction through this gearing is in the proportion of 9·5 to 1. A motor also drives the furnace-charging machine. The motors are of the enclosed type, having four poles and slotted armatures. They are of 30 H.P., but when called upon they can give out 80 H.P. each. A single lever actuates the starting, stopping, and reversing arrangements, and each motor has a controller to govern it.

In the American Institute of Electrical Engineers a valuable discussion took place on the question of the advantages of subdividing the power for driving workshops by electrical means. One member showed by experimental results and by diagrams that three small motors of total equivalent power to a large one effected a saving of from 15 to 20 per cent. by the indirect saving in consequence of the idle period of some of the machines driven. The initial cost of the motors, when their aggregate capacity was 50 H.P., was 28 per cent. higher for three machines than it was for one machine; and when the aggregate capacity was 100 H.P. the initial cost of the three machines was 2 per cent. higher than for one machine. Belts were a great source of waste of power, and the change effected in the Government printing office in Washington an increase of 15 per cent. on the output, the daily running expenses of the establishment being £2,200. In that place 5 H.P. motors were used for light machines and 10 H.P. for heavy ones. Another member gave a case in which 14,000 books were produced at a fuel cost for power of £9 per day, and after the change to motors 22,000 books were produced at a fuel cost of £1 14s. per day; and this covered the cost of power, lighting, and elevators in a twelve-storey building. Another case was given where 100 sewing machines were driven with separate motors to prevent the whole of them being thrown idle with the one break down. Another member pointed out that one-third of the machines only were at one time in operation, and that shaft losses lay between 18 to 68 per cent. of the whole energy supplied. From trials made, another member said he never found the shaft losses below 50 per cent. of the total load.

The saving in power by using Electrical Motors on board Ship.—Some further arguments have been brought forward in favour of installation of electric motors on board the United States warships. It is pointed out that the saving in steam alone would be 67 per cent. It has been overlooked what this would mean in weight of boilers, feed-water and evaporators, feed-water heaters, etc. Where the steam equipment required is for 2,400 lbs., the total weight of the necessary machinery is 876,000 lbs.; while for the same power the electrical equipment would be 612,900 lbs., which shows 263,100 lbs. less weight to carry with the ordinary machinery; with specially designed machinery for this the weight would be 498,000 lbs. less than for steam, which shows a saving of more than 50 per cent.

A Magnetic Clutch.—This is the invention of Mr. Bion J. Arnold and a number of them are in use. It consists of two simple discs of heavy mass fitted with magnetic coils. When the current is turned on through the coils the discs become magnetised and the discs are drawn together. When release is wanted the current is switched off. But magnetic action is not the sole one which is depended on for producing sufficient friction. The surfaces are rough, and the magnetic force produces simply sufficient force to prevent them from slipping over each other. Up to the present the largest clutches which have been made are 100 in. in diameter, and this one is transmitting 300 H.P. at 150 revolutions per minute. It is used for connecting the engine and generators in a large central station. The current is carried to the clutch coils through central rings on the side of the clutch. Carbon brushes are the means of contact with those rings. The current required is about 2·5 amperes at 100 volts, and the loss of current while in use is about ·001 of the power transmitted.

Trinity House and Wireless Telegraphy.—The *Times* has been accusing the Elder Brethren of not being up with the times in this matter. A letter has been sent by direction of the Elder Brethren on the matter. It says: "That evidence has recently been given that property to the value of £52,000 has been saved from loss by the establishment of wireless telegraphy between the East Goodwin lightship and the South Foreland; and that in spite of these facts the Brethren of the Trinity House move slowly in the matter. I am desired by the Elder Brethren of the Trinity House to inform you that they think it will be found that they were amongst the first in this country to move in the matter in the public interest. The experiment at the South Foreland commenced at Christmas, 1898. The board afforded the necessary accommodation to the Wireless Telegraphic Co. free of charge, and aided and encouraged them in every way, being from the outset favourably impressed by the advantages of the system. The Elder Brethren have, however, good grounds for stating that the alleged facts as to the saving of property of the value of £52,000, by means of this particular connection, are incorrect; and whilst they are of opinion that electrical communication with light ships might, in certain circumstances, be the means of saving life and property, they do not consider that any property which would otherwise have been lost has been so far saved through the agency of electrical communication of any description with light-vessels on the coast of England." The letter is answered by Major S. Flood Page, the managing director of the Wireless Telegraph & Signalling Co.

The Electrical Installation of the "Oceanic."—There are fitted on board the *Oceanic* 1,975 lamps. Of this 350 are in the engine and boiler rooms, and motor heaters, etc., take quite as much current as that supplied to the lamps. There are four dynamos of the four-pole type compound wound each with an output of 100 volts 600 amperes, and a speed of 240 revolutions per minute. They are driven with direct coupled engines of the compound twin type with cylinders 11 in. high pressure, 18 in. low pressure, and 11 in. stroke. Heavy fly wheels are fitted in the shaft to give steadiness of light. Each dynamo has an output of 1,000 16-candle-power lamps. Two of the engine dynamos are starboard, while the other two are port, and they are separated by a water-tight door. There are 28 circuits. The leads for the saloons, libraries, smoke rooms, etc., receive current from three independent circuits, in case the fuse of any one main should be blown. The wiring is in the single wire system, and the skin of the ship forms the return wire. The radiators for the electrical heating require from $7\frac{1}{4}$ to 10 amperes at 100 volts. There are electrical motors for fans for stores' hoist. Fog whistles are worked by a magnet, and they blow for a short time then stop for another short time,

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from December 22nd, 1899, to January 23rd, 1900 :—

Underhill, A. M., engineer to the *Jupiter*, to date December 21st.

Upton, S., has been appointed engineer R.N R.

Vining, H. P., chief engineer to the *Duke of Wellington*, additional for the *Gibraltar*, to date January 1st.

Wallis, H., engineer to the *President*, for service at Elswick, to assist the overseer in the inspection of mountings of naval guns, undated.

Watch, J. S , fleet engineer to the *Duke of Wellington*, for the *Cressy*, to date January 10th.

Watson, Lewis J., engineer to the *Pembroke*, additional, for the *Argonaut*, to date January 2nd.

Watson, L. J., engineer, to be lent to the *Vernon* and *Excellent* for course of torpedo and hydraulic instruction, commencing January 3rd.

Williams, G. A., has been appointed assistant engineer R.N.R,

Wilson, W. A., engineer to the *Victory*, for the *Crane*, in lieu of a chief engineer, to date February 20th.

Wood, A. C. (probationary), assistant engineer to the *Vivid*, additional, for the *Ocean*, to date January 1st.

From January 24th, to February 20th, 1900 :—

Allden, F. A., chief engineer to the *Royal Arthur*, for the *Katoomba*, to date February 15th.

Aston, S., staff engineer to the *Diana*, to date February 15th.

Ayers, R. B , engineer to the *Vernon*, for the *Starfish*, to date February 6th.

Bain, D. H. W., assistant engineer (temporary) to the *Wallaroo*, undated.

Baker, J. G. L., staff engineer, to the *Mildura*, undated.

Batley, A. W., assistant engineer, has been promoted to be engineer, R.N.R.

Bingham, P., engineer to the *Royal Arthur*, for the *Boomerang*, to date February 15th.

Block, R. J., engineer to the *Ocean*, to date February 20th.

Cox, A. E., chief engineer to the *Pembroke*, for the *Scylla*, to date February 10th.

Crisp, A. S., engineer to the *Duke of Wellington*, for the *Chamois*, undated.

Cunningham, J. E. G. (probationary), assistant engineer to the *Ocean*, to date February 20th.

Davies, W. R., engineer to the *Tamar*, for Hongkong Yard, to date February 20th.

Davis, R., assistant engineer to the *Diana*, to date February 13th.

Dawson, F. G., engineer to the *Cambridge*, for the *Shark*, to date February 2nd.

Dixon, A. G., engineer, R.N.R., to the *Duke of Wellington*, for instructional course, commencing February 6th, at Portsmouth.

Drake, S. J., engineer to the *Vivid*, for the *Locust*, to date February 2nd.

Dupen, A. P. L., engineer to the *Phœnix*, undated.

Edwards, E., engineer to the *Wildfire*, for the *Desperate*, undated.

Edwards, G. K., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Edwards, G. K., chief engineer to the *Royal Arthur*, for the *Katoomba*, to date February 15th.

Elgar, G. H., assistant engineer (temporary) to the *Ocean*, to date February 20th.

Fletcher, W. M., engineer, R.N.R., to the *Duke of Wellington*, for instructional course, commencing February 6th, at Portsmouth.

Grant, W. C. G. R. J. (probationary), assistant engineer to the *Pique*, to date February 15th.

Hammond, C. E. J., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Hare, J. S., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Harrison, J. H., assistant engineer to the *Howe*, to date January 31st.

Hatchie, D., engineer to the *Vivid*, for the *Fairy*, to date February 2nd.

Highet, W., senior engineer, R.N.R., to the *Duke of Wellington*, additional, for instructional course, commencing February 6th, at Portsmouth.

Howle, C., assistant engineer (temporary) to the *Edgar*, to date February 20th.

Hughes, H. R. S., assistant engineer to the *Vivid*, to date January 31st; for the *Pique*, to date February 15th.

Jacobs, F. G., chief engineer to the *Royal Arthur*, for the *Katoomba*, on recommissioning, to date February 15th.

Jeffery, G. H , assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Johnson, H. H., assistant engineer to the *Ocean*, to date February 20th.

Kerr, J , fleet engineer to the *Duke of Wellington*, for the *Latona*, on paying off, to date February 8th.

Knight, G. G., engineer to the *Tamar*, for the *Hart*, in lieu of a chief engineer, lent to the *Edgar*, for voyages, to date February 20th.

Lawrance, W. W., chief engineer to the *Salamander*, to date January 29th.

Longland, W. E., assistant engineer to the *Majestic*, to date January 31st.

Ludlow, G. T. J., chief engineer to the *Duke of Wellington*, to date January 30th, for the *Gladiator*, to date February 15th.

Macdonald, P , engineer, R.N.R., to the *Duke of Wellington*, for instructional course, commencing February 6th, at Portsmouth.

Manning, H. L., chief engineer to the *Vivid*, additional, as engineer overseer at works of Messrs. Doxford, Sunderland, and Palmer's Shipbuilding Co., Jarrow, to date February 10th.

Monk, J., fleet engineer, has been placed on the retired list.

Moorshead, H. B., engineer to the *Vivid*, for the *Osprey*, to date February 2nd.

Moss, F. S , engineer to the *Cambridge*, for the *Ferret*, to date February 2nd.

Muir, P., engineer, R.N.R., to the *Duke of Wellington*, for instructional course, commencing February 6th, at Portsmouth.

Parry, R. W., engineer to the *Vivid*, for the *Opossum*, undated.

Pearce, W. W., engineer to the *Defiance*, for the *Lynx*, to date February 2nd.

Percey, J. J. G. G., engineer to the *Excellent*, for the *Wizard*, to date February 6th.

Pibworth, W. H., fleet engineer to the *Duke of Wellington*, for the *Naiad*, to date January 30th.

Reed, W. W., assistant engineer to the *Defiance*, to date February 20th.

Reynolds, J. A., engineer to the *Pembroke*, for the *Skipjack*, in lieu of a chief engineer, to date February 10th.

Ripley, T., engineer, R.N.R., to the *Duke of Wellington*, for instructional course, commencing February 6th, at Portsmouth.

Roberts, J. E. S., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Sharp, W., fleet engineer to the *Ocean*, to date February 20th.

Snook, V. E., engineer to the *Wildfire*, for the *Zebra*, undated.

Soper, E. P., assistant engineer has been promoted to the rank of engineer in Her Majesty's fleet.

Spalding, A., fleet engineer, has been placed on the retired list of his rank, at his own request.

Sparke, H. P., engineer to the *Excellent*, for the *Teazer*, undated.

Sparks, H. P., engineer to the *Duke of Wellington*, for the *Teazer*, undated.

Sparrow, F. W. (probationary), assistant engineer to the *Polyphemus*, to date January 31st.

Spry, F. M. D., chief engineer to the *Dido*, to date January 29th.

Steward, C. H., fleet engineer to the *Wallaroo*, undated.

Stone, C. E., assistant engineer to the *Royal Arthur*, for the *Ringarooma*, to date February 15th.

Thorne, C. W., fleet engineer to the *Vivid*, for the *Charybdis*, to date February 15th.

Toop, W., engineer to the *Melampus*, for the *Gossamer*, to date February 15th.

Tucker, J. N., assistant engineer to the *Royal Arthur*, for the *Katoomba*, undated.

Walker, J. J., fleet engineer to the *Royal Arthur*, for the *Ringarooma*, to date February 15th.

Wallace, C. J. M., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Watson, J. H., chief engineer to the *Diana*, to date February 15th.

Wand, E. V., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Webb, A. T., chief engineer to the *Pique*, to date February 15th.

Webster, G. P., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Weeks, C. M. (probationary), assistant engineer to the *Royal Arthur*, for duty in the *Europa* on voyage out, to date February 15th.

Weeks, E. J., engineer to the *Torch*, to date February 1st.

White, A. F., engineer to the *Algerine*, lent to the *Edgar* for voyages, to date February 20th.

Wood, A. O. (probationary), assistant engineer to the *Ocean*, to date February 20th.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

WHILST there is still enough work on hand in Clyde shipyards and engine shops to keep all hands well employed for months to come, the situation as regards the demand—or rather non-demand—for new tonnage is causing some uneasiness on the part of firms having establishments with great productive capacities. Speaking with a gentleman at the head of one of the largest Clyde concerns the other day, our Clyde correspondent was told that never before had the company with which he was connected been so long, not only without booking an order, but without so much as an enquiry! This, of course, is not entirely representative of the state of things generally prevailing, as several very good orders have been placed on the Clyde since the year began by companies of necessity compelled to place orders, and well enough able to do so in the face of the abnormal prices ruling. Enquiries have also been made in some cases by owners who have let out their vessels as transports, and who are convinced that these will be engaged beyond the six months fixed. The fact, however, remains that few contracts for new steamers have been booked, and that there is absolutely nothing offering in the way of orders for general trading or tramp merchant ships. The extraordinary height to which prices of material have risen and stuck, conjoined to the paralysing effect of the war in South Africa, and its unseen but nevertheless real influence on our international trade relations, may be taken as the major cause of this condition of affairs.

The satisfactory fixing recently of the ironworkers' wages for another term has been a redeeming feature in the iron and steel industry. The official figures of the Scottish Manufactured Iron Trade Conciliation Board show that the selling price for November-December was £7 8s. 7·73d. and from statistics it is found that for the same two months last year the average price was £5 12s. 7·65d. per ton, which at once shows the real advances netted by manufacturers. A rise of £1 16s. per ton appears most satisfactory, but makers affirm that profits in proportion to the turnover, cost of material, and wages are small. During the month ship-plates have been held for £8 10s. to £8 12s. 6d. per ton, against £7 to £7 5s. at this time last year. Boiler-plates have been quoted at £9 10s. against £8 last year, and angles at £9 5s. to £9 7s. 6d. as compared with £6 2s. 6d. a year ago.

Whilst new orders on the Clyde have been practically *nil* during the month, the work of turning out vessels has proceeded apace, and the month's output is at least an average figure. The largest vessel turned out was the twin-screw steamer, *Sabroan*, which Messrs. Caird & Co., Greenock, launched for their friends, the P. & O. Co. She is 7,300 tons gross, and 450 ft. in length, and will be provided with engines capable of driving her at a speed of 16 knots an hour.

In our October notes reference was made to the closing of the shipyard at Greenock, for some years past carried on by Messrs. Carmichael, Maclean & Co. Operations, however, have since been carried on by Messrs. Russell & Co., of Port-Glasgow, as far as the completion of work in hand at the time of the stoppage is concerned. Mr. Carmichael, as noted in last month's notes, has now gone to be manager in the yard of Messrs. Craig, Taylor & Co., Stockton-on-Tees. Operations have now also been stopped—temporarily it should be hoped—in another Greenock yard, viz., that of Messrs. Taylor & Mitchell, at Garvel Dock. The firm have been rather slack of late, and it was reported on the 17th ult. that the men had been paid off and the yard closed. There are no vessels on the stocks at present. The yard had been open for about two years only.

There has been no stoppage of operations, but the proprietary of the old established shipbuilding and engineering business of Blackwood & Gordon has undergone a complete change as regards its active working partners. These for a number of years have been Mr. D. B. McGeoch, Mr. F. P. Purvis, and more recently Mr. J. H. McAlpine. A large financial interest in the concern has been held for a considerable time by Sir William Arrol, M.P., and Lord Overtoun. Both these gentlemen still retain their holding, but since the 1st ult., they have associated with them as working partners Mr. Robert Carswell, until recently partner in the Ailsa Shipbuilding Co, and Mr. John Reid, formerly with Messrs. Alexander Stephens & Sons, Linthouse. This new syndicate, at a meeting of the creditors of the concern as hitherto conducted, early in the month, offered them a composition of 16s. in the £, and this has been accepted. Under the new régime it is reported important additions are to be made to the shops and machinery. A patent hauling-up slip for the repair and overhaul of vessels is a recent and profitable branch of the business.

Messrs. Matthew, Paul & Co., Levenford Works, Dumbarton, who are makers of the apparatus and fittings involved in the thermo-tank system of heating and ventilating passenger and other vessels invented by Mr. Stewart, of Clydebank, are installing the system on board the two huge Cunard liners *Ivernia*, built on the Tyne, and the *Saxonia*, launched from the Clydebank Shipyard about the end of last year. This well-known Dumbarton firm also continue busy with their ordinary fan engine specialities. In their launch department they have just completed for owners abroad, for whom Mr. David Pollock, M.I.N.A., Glasgow, is naval architect, a high-speed steam launch, suited for harbour service. The little craft underwent her speed trials satisfactorily on the Clyde recently and has now been shipped to her destination in the East.

The recent bursting of one of the tube elements in the water-tube boiler on board the Clyde passenger paddle steamer *Meg Merrilees*, which resulted in the scalding and subsequent death in the infirmary of the fireman in attendance, has led Captain James Williamson, the marine superintendent for the Caledonian Steam Packet Co.—whose care and solicitousness for the safety and comfort of all connected with his company's service, as well as the general travelling public, are so well-known—to give out orders for the substitution of a cylindrical boiler of the ordinary type for the water-tube boiler which recently broke down. This hardly means that he has lost faith in the water-tube generator as having many points of advantage over the cylindrical boiler, but in the present state of uncertain knowledge with respect to the working principles and proper upkeep of the water-tube type it is inadvisable to have them on board his company's vessels. The new boiler of the ordinary type for the *Meg Merrilees* is being made by Messrs. A. & J. Inglis, of Pointhouse.

Messrs. John Macdonald & Son, engineers and machinery agents, of York Street, Glasgow—who are agents for the pneumatic drilling, caulking, and riveting tools of American make, which have been exhibited at work in several of the largest shipyards and boiler works in each of the principal districts in Britain—inform me that the riveting tools are now meeting with ready adoption, as well as the caulking and drilling tools, which have from the very first met with the greatest acceptance. Several of the largest Clyde firms—amongst them Messrs. Denny, Dumbarton, and Messrs. Russel & Co., Port Glasgow—have ordered installations of pneumatic plant, comprising the several kinds of tools and the necessary air compressors, and these will be at work in a short time. A new riveting hammer, only weighing about 12½ lbs., and of a stroke of 9 in. instead of the 6-in. stroke hammers hitherto in use, has recently been tried for the first time on this side of the Atlantic—although it has been in daily use in America for a considerable time—in the yard of Sir James Laing, at Sunderland. It is capable of knocking up rivets of 1¼-in. diameter, and on bulkhead work, with ¾-in. rivets, as many as 120 rivets have been closed in one hour.

The output of coal in Scotland 24 years ago, according to Mr. Henry Aitken, of the Cadzow Coal Co. (who referred at length to the subject when presiding at the recent semi-jubilee dinner at the Glasgow Colliery Representatives), amounted to 16,000,000 tons a year, whilst in 1898 it was 30,000,000 tons, and for 1899, although the actual figures were not yet available, it could be taken at 31,000,000 tons. As regards prices, they had moved in proportion, viz., had doubled themselves. Prices had gone up so much of late, simply because there was not sufficient coal coming out, or at any rate not so much being got forward as to meet the requirements. The increased demand had been brought about exclusively by the enormous trade activity which had prevailed all over the world, and, as coal entered very largely into the state of activity of general trade, its output and cost increased proportionately. No doubt the present scarcity, to some extent, was due to the inability of the railway companies to provide sufficient facilities for its transit. The railway companies, however, were like colliery concerns, formed with the object of making a profit, and they had increased their trade even more rapidly than had the coal trade. As an instance of this he stated that in 1875 the North British Railway Co. carried 5,600,000 tons of mineral traffic, whereas in 1899 the quantity was 16,000,000.

Cumbrae Lighthouse, which with Cloch Lighthouse further up the Firth of Clyde, forms the two objective points of the phrase "Between the lights," so well known to nautical men and to shipowners and shipbuilders in connection with speed trials of ships, has just had electric light installed in place of oil and made flashing instead of fixed. It now gives two flashes in quick succession every half minute. The light can be run either direct from the dynamos or from a set of cells. The dynamos, one of which is spare, are driven by oil engines, of which there are three, any one of which can be used to drive the pumps for supplying air to the siren fog signal. The lenses, with a dioptric converging mirror of an entirely novel design, which utilises about double the amount of light from an ordinary dioptric mirror, revolve on steel rollers on conical steel paths, the motive power being an electric motor with worm gear. The oil for the engines, landed at the bottom of the cliff, is pumped up to the top by an electric motor pump. The whole forms an establishment which, in many particulars, is so far removed from any lighthouse establishment in this or other countries as to be absolutely unique. The whole has been effected from designs by Messrs. D. & C. Stevenson, Edinburgh, engineers to the Clyde Lighthouses Trust, the contractors having been: for the optical apparatus Messrs. Lepante, Paris; for the electric plant, Messrs. Walter Dixon & Co., Glasgow; for the oil engines, Messrs. the Campbell Gas and Oil Engine Co., Halifax.

Messrs. Gourlay Brothers & Co., engineers and shipbuilders, Dundee, have obtained a contract to build a steamer for T. & J. Brocklebank, Liverpool. The dimensions are as follow:—Length, 445 ft.; breadth, 50 ft.; depth, 33 ft.; and the tonnage is 5,820. The same firm have contracted to supply the engines for a vessel to be built of wood for Antarctic exploration purposes by the Dundee Shipbuilders' Co., Limited.

The company just named are presently laying the keel of the wood vessel in question. This vessel, which is to the order of the Antarctic Exploration Committee, will be 172 ft. long by 33 ft. beam, by about 16 ft. mean draught, and 1,570 tons displacement. The hull is to be constructed generally of oak, with an outer sheathing of greenheart, and will be specially strengthened for ice pressure. A magnetic observatory is to be fitted on upper deck amidships, and to obviate any magnetic interference, all metal fittings for a radius of about 30 ft. are to be of brass. The deck is to be lined with asbestos, and the machinery will be placed aft. The vessel, which will be barque-rigged, is to be finished by March, 1901. The price, exclusive of the engines, is £33,700.

The Caledon Shipbuilding Co., who are now laying the keel of the 230 ft. long steamer for the African Steamship Co., noticed in last month's notes, have launched during the month the *Salmo*, a vessel of 1,700 tons for Thomas Wilson, Sons & Co., Hull, being the fifth vessel recently built by the company for the same owners.

After all the local fuss and Parliamentary fighting, it is not by any means improbable that the Clyde Trust will come to terms with the holders of the Renfrew Dock Bill, and take the scheme up and carry it to a practical conclusion relinquishing their own scheme of docks at Shieldhall higher up the river. The committee of management of the Clyde Trust at a meeting held on the 16th ult. had under consideration the proposal to acquire the Renfrew Dock. The discussion lasted several hours, and ultimately it was resolved by an overwhelming majority that the negotiations should be continued, and there is every reason to believe that they will be carried to a successful issue. One of the conditions laid down by the Renfrew authorities is that they shall have two representatives upon the Clyde Trust, as reconstituted, and to this proposal it is not likely that any serious opposition will be offered. Though the Bill to be presented by the Clyde trustees in the present session of Parliament concerned with the Shieldhall Dock scheme contains no reference to the Renfrew Dock, it is understood that there is no difficulty in the way of the necessary clauses being added.

Messrs. John Shearer & Son, Kelvinhaugh Slip Docks, Kelvinhaugh, Glasgow, are advertising for offers for the excavation by dredging and the removal of about 250,000 cubic yards (to be removed to sea) from a site on the banks of the river Clyde about 15 miles up the river from Greenock. This is in connection with the formation of new shipbuilding premises which the firm are about to establish in the vicinity of the new docks for which the Clyde Trust have powers on the north side of the Clyde, a little above Clydebank.

The total number of members in the Institution of Engineers and Shipbuilders, including associates and graduates, is now over 1,250. The increase has gone on during the past three or four years in an extraordinary manner. When the increase began with the election of the new secretary, there was somewhere between 800 and 900 members, etc., but in that time the increase has been something like 430. A membership of 1,250 in a technical society has never previously been known out of London. Of course this means assiduous beating-up on the part of individual members, and the rejection of any individual proposed—the proposal having to be backed by the names of three existing members—is a thing unknown. In the associates section a greater latitude as regards qualifications is allowed, and there is, consequently, a greater variety of professions represented. At the two last meetings all the associates elected, 13 in number, were Glasgow shipowners.

A petition having some time ago been addressed to the Institution of Electrical Engineers by 70 gentlemen engaged in electrical industries in Glasgow, for the formation of a local section of the institution, with its headquarters in Glasgow, this was subsequently granted, and a meeting was held in the rooms of the Institution of Engineers and Shipbuilders, at which the formation of the section was virtually arranged. Lord Kelvin has since been elected chairman of the Glasgow section, Professor Magnus Maclean vice-chairman, and Professor W. H. Watkinson secretary.

The Glasgow and West of Scotland Technical College Scientific Society held its seventh annual dinner on the 17th ult. in the Bath Hotel, Glasgow. Mr. David Home Morton, M.I.C.E., M.I.M.E., president of the society, in the chair. A company of about eighty members and guests were present. After dinner, Mr. Frank B. Lea, B.A., M.I.E.E., in proposing the "Navy, Army, and Auxiliary Forces," eulogised the gallant efforts of all these forces in the South African War now in progress. Lieutenant A. M. Downie, B.Sc., in replying, referred to the valuable services rendered by the scientific branches, and drew attention again to the fact that the mountings of the 4·7 in. naval guns from the *Powerful*, which have enabled Ladysmith to hold out so gallantly and so well, were designed and fitted by the engineers of the naval service. "The Lecturers" was given by the secretary, Mr. Andrew Stewart, A.I.E.E., and was responded to by ex-Provost William Shanks, of Barrhead. Mr. Shanks, who had delivered the most recent lecture to the society, spoke of the great value to the civilised world rendered by science, and thought that the Glasgow and West of Scotland Technical Scientific Society was doing good work in its own sphere. In proposing the toast of "The Technical College Scientific Society," Mr. David Pollock, M.I.N.A., complimented the members on the position which the society now occupied amongst the institutions of the West of Scotland established for similar objects. It had been in existence for about eight years, and during that time it had been most fortunate in the matter of having for presidents and vice-presidents men of scientific education and great practical experience, holding foremost positions in the industrial world, and of having had in the way of lecturers men of high repute in engineering and scientific circles, such names as those of Professor Archibald Barr, Professor J. G. McKendrick, Professor W. A. Watkinson, Professor Magnus Maclean, Professor H. Sexton, Mr. James Riley, &c., being examples of this. In the matter of secretaries the society had been equally fortunate, as was evidenced by the presentation on that occasion of an illuminated address of thanks to Mr. Robert A. Raphael, a former secretary; and by the fact that the present secretary, Mr. Andrew Stewart, A.I.E.E., had been instrumental, aided by the committee, in raising the membership during the past three sessions from 95 to 155.

THE TYNE.

(*From our own Correspondent.*)

Shipbuilding.—During the first half of February work has been practically at a standstill in the shipyards, and the progress made in the construction of vessels has been so small as to be scarcely noticeable. The state of the weather was of course responsible for the prolonged stoppage which—coming so soon after the New Year holidays—has proved particularly inconvenient to both employers and employed. The loss of wage, caused by the interruption to work in the shipyards of the North, would be exceedingly difficult to estimate; but, as there are some forty firms paying from £1,000 to £2,000 weekly in wages, the total loss cannot have been much below £100,000. Possibly some of this may be made up by more regular attendance on the part of the workmen when climatic conditions are again favourable for operations, and it is to be hoped that the different sections of operatives will view the matter in this light, and take advantage of such opportunities as may be afforded for making good the loss that has been sustained.

The greatly enhanced cost of tonnage still seems to act as an effectual check upon speculative enterprise in shipbuilding, and, though enquiries are still heard of, it does not appear that they very often result in the placing of orders. It is pretty generally understood, however, that the work placed before the close of 1899 is sufficient to keep all the principal yards going briskly for a good many months, and the evident lack of new orders at this juncture will not immediately affect the state of business in the yards. The impression exists in well-informed quarters that new orders will be forthcoming in abundance, as soon as the Baltic and other icebound seas become open for traffic, and when shipowners realise that a reduction in the price of tonnage is not a contingency to be depended upon.

The Low Walker yard of Messrs. Armstrong, Whitworth & Co. continues to have all the berths occupied, the vessels in hand consisting of two mail boats, of exceptional capacity; one cargo steamer, and three dredgers, which are being built for service in India and Australia. The Elswick yard of the firm is also quite full of work, one or two of the larger vessels being well advanced towards completion. At the yard of Messrs. Wood, Skinner & Co. there are four vessels in hand, two of them being in early stages of construction, and two well advanced. Messrs. W. Dobson & Co. have a very large vessel in the plating stage, and two medium-sized boats in the course of framing. The large vessel, it is understood, is ordered by a London company, and is intended for service in the colonial trade.

Messrs. Wigham-Richardson & Co. have, at the moment, two berths vacant; but it is probable they will be occupied with vessels of an important class ere long. One of the five vessels now on the stocks is well advanced towards completion, the others being in the framing or keel-laying stages. The s.s. *Attila* is moored beside the yard, and is undergoing rather an extensive overhaul. The equipment of the large steamer which Messrs. Swan & Hunter are building for the Cunard Co. is now nearly completed, and the vessel will very shortly be placed on the station intended for her. There are two other vessels being fitted out beside the yard, and all the berths are occupied with boats in various stages of building.

At the yard of Messrs. Hawthorn, Leslie & Co. there is a large vessel intended for the colonial trade, nearly ready for launching, and two others of good size in earlier stages. The firm have five torpedo-destroyers in hand, three of which are on the stocks and two in the water. They have also a couple of merchant vessels fitting out beside the quay.

The Palmer Co.'s yard has an exceptionally busy appearance, though in this case, as in others, operations have been greatly impeded by the weather. Every possible exertion is being made to forward the construction of the battleship which the company are building for the Admiralty, and, notwithstanding the unfavourable elemental conditions, fair progress has been made. There are half-a-dozen merchant vessels in hand, most of them being of large size, and there are also some vessels under repair, amongst which may be mentioned a Chinese steamer, the *Ching Wo.* The Tyne Shipbuilding Co. have their berths fully occupied, and are fitting out the Stag liner *Zinnia* beside the yard.

The large graving dock belonging to the Wallsend Slipway Co. is now occupied by the Italian steamer *Savoia*, which is to be cut asunder amidships and lengthened 66 ft. This, it will be seen, is a very important contract, and it will pretty fully engage the resources of the Slipway Co. for the next three or four months.

There is another very important lengthening contract in the hands of the Wallsend Pontoon Co., the vessel in this case being the s.s. *Wittekind*, belonging to the Norddeutscher Lloyd. She is to be lengthened 60 ft., and is, besides, to have a complete bottom repair, which will involve the renewal of the flooring, keelsons, and other structural parts. It is estimated that the contract will occupy the services of over 200 hands for the greater part of the current year.

Messrs. Readhead & Sons launched on the 17th ult. a large cargo boat named the *Cayo Soto*, built to the order of the Cuban Steamship Co., Limited. The vessel is now lying beside the yard awaiting her equipment of machinery, &c., and there is another vessel at the quay getting her fittings completed. On the stocks there are four vessels, all in early stages, and in the graving dock department business is very brisk.

Engineering.—The North-Eastern Engineering Co. have a large amount of work in hand, and two vessels are just now receiving or awaiting machinery at the shearlegs. It is understood that the Wallsend Slipway Co. have received from the owners of the Shell Line of steamers, Messrs. Samuel, instructions to fit the s.s. *Rocklight*, and seven others of the company's steamers with a patented apparatus for the burning of liquid fuel in the boiler furnaces. The fitting of the apparatus involves a considerable amount of work in each vessel, and, when it is considered that eight are to be done, the contract assumes very important proportions. The probability is indeed, that, in course of time, the whole of Messrs. Samuel's steamers will be fitted with the patent oil burners, which arrangement will make the company wholly independent of coal supply. With this end in view, the company are now arranging for the establishment of depots at suitable ports on the lines of traffic traversed by their steamers, where stocks of oil can be kept, and where steamers can call for supplies when necessary. The vessels that are to be fitted with the oil-burning apparatus are also to be supplied with (in each case) a set of "settling" tanks. These tanks will be filled with oil from the vessel's cargo, which after undergoing a necessary process of purification will be utilised to supply the burners. Up to the present, the substitution of liquid fuel for coal has only been successfully carried out on oil-carrying steamers, and the system is not likely to be adopted in general cargo or passenger steamers, until oil storage depots are established at all the principal shipping centres throughout the world. The Admiralty has been experimenting with the system, especially with reference to the propulsion of torpedo destroyers, on which class of vessel the available space for fuel carriage is necessarily small. No definite result, we believe, has yet been arrived at; but it is understood that the experiments will shortly be resumed, and it is confidently expected that the outcome will be the adoption for torpedo boats, and torpedo boat destroyers, of one or other of the patented arrangements for the burning of liquid fuel.

At a meeting of the shareholders of the Wallsend Slipway and Engineering Co., Limited, held on the 17th ult., it was resolved that a dividend of 5 per cent. per annum be paid on the ordinary and preference shares for the year ending December 1st, 1899. The retiring director, Mr. G. B. Hunter, was re-elected.

The engineering department of the Palmer Co.'s works is kept very busy, and at the works of the Tyne Brass and Copper Tube Manufacturing Co. a good deal of activity is to be noted.

Messrs. Newton & Nicholson, of Tyne Dock, the proprietors and manufacturers of Taylor's corrugated packing, continue to experience a good demand for their speciality, and the works are kept actively going.

The works of Messrs. H. Watson & Sons, Walker Gate, are showing undiminished briskness—the demand for their patent ballast pumps, filters, &c., continuing to be very active.

Messrs. Donkin & Co. (late Donkin & Nichol), of the St. Andrew's Engine Works, Newcastle, have in hand a large number of orders for steering gears, engine-room telegraphs, and other specialities, and the firm still find it necessary to keep a large part of their machinery running extra hours.

Mr. W. F. Snowdon, of No. 32, Side, has been appointed the representative in the Tyne and Wear districts of Messrs. W. Christie & Co., 70, Wellington Street, Glasgow, the sole licensees for the United Kingdom for the sale of the Andrew White patent packing. This packing is described as "the patent galvanic metal paper packing," and many remarkable advantages are claimed for it, such as automatic action, security against damage, capability of standing extremely high pressures, durability, &c. It has only recently been introduced in this country, but has already achieved a very marked success.

Forges and foundries continue to be briskly employed, and in the local iron and steel works business is active. Coppersmiths and brass finishers are also doing well.

Blyth.—The important announcement that has recently been made of the incorporation of the Blyth Dry Dock Co. with the Blyth Shipbuilding Co. has excited much favourable comment in this district, the consensus of opinion being that such a "closing of the ranks" cannot but make for good to all concerned in the enterprise, as well as to the port of Blyth and the district generally. There is some probability that a marine engine works will be started in connection with the shipbuilding works ere long, and, should this expectation be realised, there is little doubt that the necessary adjuncts of forge and foundry will speedily follow. That the port of Blyth is capable of great development may be judged from the circumstance that the harbour has 8,000 ft. of quayside space, including 22 high-level coaling staiths. Work at the present time is most active at both the shipbuilding yard and the Blyth Dry Docks. At the former place extensive improvements are being carried out, whilst at the dry docks several important repair contracts are being proceeded with.

THE WEAR.

(From our own Correspondent.)

Shipbuilding.—Very few, if any, new contracts have been booked by Wear shipbuilders this year, and it would be difficult to say whether owners or builders are the least anxious to incur new responsibilities in the way of giving or accepting orders. That the former are "holding off," in the hope of securing easier terms later on, is hardly to be doubted, and that the latter—what with stress of weather and unwillingness to work when they *can* work, on the part of the workmen—are also content to rest awhile on their oars, is equally certain. At the time of writing things look gloomy enough, for the weather—after showing for a day or so one of its better moods—has again assumed its wintry character, effectually stopping outdoor work, which category, of course, includes the greater part of the operations carried out in the shipyards. To give an idea of the state of work in the different yards, it may be stated that at the North Sands establishment there are five vessels on the stocks, and one fitting out at the Manors Quay. Messrs. Blumer & Co. have four vessels in progress, and the Strand Shipbuilding Co., two. Messrs. Bartram & Son have two vessels on the stocks, and at the Sunderland Shipbuilding Co.'s yard there are four vessels in various stages of progress.

Messrs. W. Doxford & Sons are busily preparing for delivery the fine vessel launched a few weeks ago for the Peninsular & Oriental Co., and are also engaged in fitting out other vessels recently put off the stocks. There are now in course of building in the yard three large "turret" ships and a torpedo destroyer, and there is also a vessel of the latter class being fitted out in the river.

Messrs. Short Brothers have four vessels on the stocks, two of which are for local owners, and two for owners at a distance. The equipment of a vessel recently launched is also being proceeded with at the jetty, and in the designing department there is quite as much activity as usual.

Messrs. Priestman & Co. launched a vessel of large size early in the month, and have two others well advanced on the stocks. Messrs. Pickersgill have three vessels building, and at Messrs. R. Thompson & Sons' an equal number are on the stocks. At each of the last-named establishments a vessel is being fitted out on the water.

Sir James Laing & Sons are well occupied with both new and old work, and are utilising their graving docks at Deptford and Cornhill for repairing purposes. Amongst the new vessels in progress are two to be employed in the South African trade, and one or two others for special service on other important routes. The contemplated alterations in connection with the building berths in the West yard have not yet been commenced, and it is probable will now be put off till the advent of the slack period, which—however long it may be deferred—must certainly come in the long run. There has been a good demand lately for ships' boats manufactured from the old material—wood; and local builders have had as much work as they could do. Enquiries for wooden boats have come from all quarters, and there has been some difficulty experienced in meeting requirements. This revival of activity in what was looked upon as a decaying industry is significant, and seems to show that in the eyes of many owners, wood is the best of all materials for small boats. Before the introduction of steel boats the wooden boat building industry had become demoralised through the efforts of boat builders to outdo each other in supplying a cheap article. Unseasoned wood of the commonest kind was accordingly employed, and, being put together in a hasty and slovenly manner, boats were produced which were little better than death traps. This method of business, of course, brought the wooden boats into bad repute; but in spite of the general condemnation, there were still some who believed that a boat properly built of adequately seasoned wood was the best thing to trust to for saving life at sea. This belief is now becoming more widespread, and there appears to be every probability that in the future, wooden boats of the right description will be preferred for the equipment of steamers, and especially of passenger steamers, to boats constructed of steel or any other material.

Engineering.—The marine engine works continue busy, and in most cases partial night-work is maintained. Owing to the interruption to work in the shipyards, engineering contracts are now generally ahead, and such vessels as may be launched within the next few weeks will not have to wait long for their machinery. At the Palmer's Hill Works a vessel built by the Blyth Shipbuilding Co. is receiving her machinery, and at each of the other establishments the equipment of vessels is being carried out. At the Sunderland Forge and Electrical Works business continues active, there being important contracts in hand in both departments. Other forges in the vicinity are also busy, and at the foundries orders are plentiful. The Monkwearmouth Iron Works are fully supplied with work in all departments, and the demand for Bell & Rockliff's patent sections appears to have increased. Manufacturers of steering gears, ash hoists, winches, and other steamship accessories are still kept busy.

The Hartlepools.—The yards of Sir William Gray & Co. are exceedingly busy, all the building berths being occupied, and there being some good repair contracts in hand. At Messrs. Furness & Withy's yard business is also brisk, and Messrs. Irvine's establishment is in an equally satisfactory condition. Marine engine works show no diminution of activity, and at the steelworks the pressure of business is very great. Other local industries are generally prosperous, and at the docks there are some indications of increasing stir, as one or two timber-laden vessels have arrived.

Stockton.—Messrs. Ropner launched on the 16th ult. a vessel of large size, ordered by Messrs. Runciman, of Newcastle. She was named the *Ventmoor*, and will be engined by Messrs. Blair & Co. Boiler and bridge builders at this centre are greatly pressed with work, and night shift is being resorted to wherever possible. In smaller engineering works business is fairly good, and steelworks are kept going to their very utmost capacity.

Middlesbrough.—It is understood that Sir Raylton Dixon & Co. have booked one or two orders for vessels of a superior class, and have also secured an exceptionally important repair contract. Messrs. Craggs & Sons have plenty of work, and the same may be said of Messrs. Harkess & Sons. Messrs. Bolkow & Vaughan have proposed to spend a very large amount in extensions, and the putting down of new plant. Engineering works are busy, and it is understood that Messrs. Furness, Westgarth & English are about to fit eight Deighton furnaces on the s.s. *Dahome*, to replace others.

Darlington.—The Darlington Forge Co., Limited, continue to be busy in all departments, and, it is understood, have recently booked some further important contracts.

THE MERSEY.

(From our own Correspondent.)

THE marine and general engineering industries of this district continue very actively employed. In some sections, however, there is rather a falling off as regards new work. Machine tool makers are busily engaged, but are not just now securing any large weight of fresh orders. In constructive work there is also perhaps not quite the same pressure—although makers of material report no falling off—and in the general engineering trades the outlook scarcely indicates a continuance of the present activity, unless a good deal of work, now being apparently held back, is eventually brought forward. In one or two branches, however, there is no slacking off in any respect. The principal firm of locomotive builders have already nearly two years' work in hand, and other Lancashire firms have quite twelve months' orders on their books, and there is still a large weight of work coming forward, enquiries on the market representing about 80 locomotives for different railway companies. Electrical engineers are also exceedingly pressed with work.

The usual monthly returns of the principal engineering trade unions show a considerable reduction in the number of unemployed members on the books. To some extent this is due to the fact that the holiday suspensions, which last month caused a temporary rise in the out-of-work list, are now at an end, but it also indicates a maintenance of full employment throughout the leading branches of engineering. The Amalgamated Society of Engineers have now under 2 per cent. of the total membership on donation, whilst locally there is about the same proportion receiving support. In Manchester it is reported that overtime is still being largely indulged in, and that the Employers' Federation has given a point-blank refusal to the request made by the district committee of the men for an abolition of overtime on Monday nights. The Steam Engine Makers' Society have about ½ per cent. on benefit, with practically a clear book in the Lancashire towns. There are now only about 1¼ per cent. of the members of the Machine Workers' Association on benefit, either generally or in the Manchester district. Returns as to the state of trade continue very satisfactory, and the Steam Engine Makers' Society report a demand for men from the Government dockyards that they are unable to meet.

In the monthly report of the Amalgamated Society of Engineers, it is stated that recent cases have placed it beyond doubt that workmen are not entitled to compensation under the Act when working out for their employers, the *Bullfinch* disaster being cited as a case in point. "It should therefore," the report proceeds—"be definitely understood by members being sent out to the erection or repair of machinery, or on other work, that the risks incidental to such employment are not covered by the Compensation Act, and if they deem it necessary they must make their own arrangements." It may be added that some of the district committees have made arrangements covering risks on trial trips, &c.

Messrs. Laird Brothers, of Birkenhead, inform me that they have nothing new to report just now, but that they will shortly be launching H.M.S. *Mutine*.

Messrs. Brown & Co., of 49, Deansgate, Manchester, have brought out a new patent form of expansion joint for steam and other pipes. This joint has been designed to overcome the difficulties of leakage, broken flanges, cracked fittings, &c., which are so frequently met with where the ordinary expansion joints are used, particularly under high steam pressures. The shell in which the sliding pipe works is surrounded by an annular chamber provided with a special packing box and piston, the area of this annular piston being equal to that of the sliding pipe, to which it is attached by means of long bolts. Connections are made between the pipe and the annular chamber, so that the pressure is the same in both; and, as the pressure tends to force the sliding pipe in one direction and the annular piston in the opposite direction, these forces balance one another, and the pipe is free to slide in or out of the expansion joint without regard to the pressure in the same. The joints are made of steel forgings, with the exception of the glands, which are cast. The cost is somewhat greater than that of the ordinary joint, but it is claimed that the saving in pipes and repairs, &c., will more than repay the total cost. Balancing arrangements on this principle can be applied to existing expansion joints if desired, without removing the latter from their places.

During the past month there has been some fluctuation in prices in the open markets for pig-iron, but generally maker's quotations have remained firm at recent rates. Business is not coming forward in any very great quantity, buyers mostly simply covering their requirements, but still there has been a fair trade passing through. Lancashire makers are now steady at about 79s. 6d. less 2½ for foundry, with Lincolnshire 75s. 6d. net, and Derbyshire about 80s. net, delivered Manchester. Forge qualities average 74s. 2d. net for Lincolnshire; and 76s. less 2½ for Lancashire, delivered Warrington. Middlesbrough and Scotch iron showed some irregularity, and an easing tendency during the earlier part of the month, but they are now assuming a steadier tone, and Middlesbrough is again quoted 78s. 4d. to 78s. 10d. net, by rail Manchester, with Scotch iron 80s. 6d. to 81s. net, for Eglinton and Glengarnock, delivered Manchester Docks, whilst American pig-iron is quoted 75s. to 78s. net cash.

In the finished iron trade business continues active, and makers report the enquiry greater than they can entertain, as they are already heavily sold for several months ahead. There has been no further official change in list rates, but above the basis prices are being asked on new business. Lancashire bars are quoted £10 5s. to £10 10s., with North Staffordshire about the same. Sheets are now £11 5s. to £11 10s. List rates for hoops are still £10 7s. 6d. for random, to £10 12s. 6d. for special cut lengths, delivered Manchester district, and 2s. 6d. less for shipment, but export business has been done at £10 10s. f.o.b. Liverpool.

The demand for steel is brisk, with prices tending to harden. Hematites would seem to have recovered from the recent irregularity, and are now firm at 90s. 6d. to 93s. 6d. less 2½; local billets are now quoted £7 10s. to £7 12s. net; steel bars £9 15s. and £9 17s. 6d. to £10 and £10 5s. The steel plate makers have agreed on a basis of £10 5s. less 2½ for boiler plates, delivered in the Manchester district.

In the metal market there is no material change to be noticed. There is an active demand for all descriptions of manufactured goods, especially for locomotive builders, boiler makers, and electrical engineers' requirements. List rates remain unaltered, but the tendency is to harden. Delivered Manchester district, prices are as under: —Solid-drawn brass boiler tubes, 9d.; condenser tubes, 10½d.; copper tubes, 11½d; brazed copper, gas and steam tube, 11¼d.; brazed brass tubes, 10d.; common rolled brass, 8¾d.; common brass wire, 8½d; copper wire, 8½d. per lb.

Business in the timber trade has been steady, with little fluctuation in values. Arrivals have been fairly moderate, and deliveries generally satisfactory, and stocks all round are comparatively light. Owing to the strong advance in values asked for Canadian woods, little progress has so far been made in contracting for next season. Several parcels of teak squares have arrived by steamer, but there has been rather more enquiry, and stocks are of fairly moderate compass, with prices steady. Planks have arrived freely, and continue in fair request at firm prices; stocks are not excessive. There have been no arrivals of greenheart, but the stock is sufficient for present requirements. There is a good demand for piling logs and wood of extreme size.

In the coal trade there has been a pressure of demand all round, the severe weather having greatly increased the requirements for housefire coals, whilst the recent active enquiry for the lower descriptions suitable for iron-making, steam, and general manufacturing purposes is fully maintained. The heavy snow and the frost have also caused a blockage of transit by road, rail, and canal, and in some cases works have had to be temporarily closed owing to the inadequacy of the deliveries of coal that collieries have been able to make. Prices are firm, with a hardening tendency, and the Manchester collieries have levelled their rates up to a full 1s. 8d. advance, making the upward move on their part equal to that made last month by the West Lancashire collieries. In the open market special rates are ruling where buyers not under contract wish to obtain supplies. At the pit mouth list prices are about 14s. 6d. to 15s. 6d. for best house coal; 13s. to 14s. for medium; 12s. to 12s. 6d. steam and forge coal; 9s. 6d. to 10s. for medium; and 10s. 6d. to 11s. for best slack.

For shipment the demand continues to increase, with prices shorter if anything, and where cargoes are absolutely needed for prompt shipment, high rates have to be paid, *i.e.*, about 15s. 6d. to 16s. for ordinary steam coal, and 16s. 6d. to 17s. for better qualities delivered ports on Mersey.

In the coke trade enquiry continues in excess of the supplies, and higher prices are asked here and there, but list rates for foundry and furnace sorts remain without official alteration.

Trade continues good in the engine and boiler shops of Liverpool and Birkenhead. A fair amount of new work is in hand, and repairs and oddment work have come in pretty freely, so that shops and hands have been well employed. The fitting out of transports has gone on steadily, and has found a good deal of work for nearly all branches of the local ship building and fitting shops. Fresh steamers have been chartered by the

Government during the month and there is every prospect of transport work being an important item to Liverpool and Birkenhead builders and fitters for some time to come.

Ships' tank and cable makers have also been well employed. The former have had some good orders on transport account, special provision for a water supply having to be made on some of the steamers.

The local makers of refrigerating machines for ships' use are busy. The Liverpool Refrigeration Co., Limited, have a large amount of work on order, and Messrs. Arrowsmith, Sinclair and Co. are also busy with work of this kind at the time of writing. The making of machines for refrigerating store-rooms on ship-board has become an important branch of the engineering trade, and all of the principal makers of such machines have been very busy for months past. Most of the ocean steamship companies, passenger and cargo, have gone in for refrigerated store-rooms on their steamers, so that there has been a large demand for machines for the work. The Liverpool makers of these machines have had orders to supply several steamers of leading lines, and at the present time have much work of the kind in hand.

Graving-dock work has been fairly brisk on both sides of the Mersey since the year came in. This work finds much for fitters and coppersmiths to do, so that it has helped to make for the general prosperity. The "middle" graving-docks of the Mersey Docks and Harbour Board at Liverpool and Clover, Clayton and Co.'s docks at Birkenhead have been in almost constant use.

In illustration of the readiness of the Mersey Docks and Harbour Board to provide new machinery and appliances, to which reference was made last month it may be mentioned that at the meeting of the Board on January 15th the proceedings of the Works Committee were confirmed. These included the acceptance of a tender for providing an electric lighting installation for the cattle wharf at the north end of the Prince's Landing Stage. A recommendation of the Warehouse Committee to provide two new hydraulic tobacco presses at the Stanley Dock Warehouses, at an estimated cost of £1,400, was also approved of.

The result of the trials of H.M.S. gunboat *Britomart*, which was built by Messrs. W. H. Potter & Sons, Liverpool, and engined by Messrs. Fawcett, Preston & Co., Limited, also of Liverpool, were received in the district with great interest and were regarded as very satisfactory. The *Britomart* is a sister ship to the *Bramble*, which was built and engined by the same firms for the Admiralty a short time ago. It is hoped in marine engineering circles in Liverpool, in view of the recent evidences which have been given of the capacity of local yards to produce good Admiralty work, that more work of the kind will find its way to the Mersey. The objection which is sometimes raised, that the Mersey is too crowded a river for launching, is ridiculed by those who live on the banks of the Mersey and know the river best. That many ships, large and small, use the Mersey daily is true, but the part of the river used by ships of any size is a broad and deep estuary, in which a fleet of Atlantic liners or warships can ride and manœuvre safely. Hitherto Liverpool and Birkenhead builders have easily launched all the ships they have built, and there have been no mishaps. If orders reach the Mersey, the ships will be built and launched in spite of the traffic on the river.

Since the references to the Liverpool Salvage Association, which appeared in the MARINE ENGINEER of February, were penned, the annual meeting of this association has taken place at Liverpool. At the meeting Mr. J. Kidman, who presided, made certain observations which fully supported the references to the association made last month. He spoke of the association as the only completely equipped salvage association in the United Kingdom, having powerful and up-to-date wrecking steamers and appliances. He admitted that there were other salvage bodies in the country, but they, for the most part, employed other people. The Liverpool association was unique, as its servants did the work themselves, not for profit, but for the benefit of underwriters and others who employed them. Mr. Kidman referred to the appointment of divers who were mechanics, to the permanent crews of their wrecking steamers, and to the new diving gear, which was supplied with telephonic apparatus; as evidences of the advance and improvements which were made in their service from time to time.

Another association which holds a foremost place amongst the steamship-owning communities of the United Kingdom, the Liverpool Steamship Owners' Association, has also held its annual meeting at Liverpool during the month. Some remarkable figures in reference to the steam shipping of Liverpool appeared in the report which was submitted at the meeting. The tonnage of the vessels owned by members of the association was stated as 2,221,824, representing 20 per cent. of the total British steam tonnage afloat. For the first time since the formation of the association in 1858, the tonnage owned by members exceeded 2,000,000 tons. The members of the association were the owners of 25 per cent. of the total number of British steam vessels of the speed of 12 knots and upwards, and of 28 per cent. of the total number of British steam vessels of above 3,000 tons. Upwards of two-fifths of the vessels chartered by the Government for the war belonged to members of the association. The announcement of the foregoing figures produced a pardonable feeling of elation, not only amongst the steamship owners but in all branches of the shipping trade in Liverpool. They are totals which it would be hard to match and of which any port might be proud.

Among the many matters touched in the annual report of the Liverpool Steamship Owners' Association was that of the need of an adequate reserve of skilled engineers and firemen for the Royal Navy. It was pointed out that as many engineers and firemen were now required for the Navy as seamen, but that the great resources of the country in trained engineers and firemen were entirely overlooked. The belief was expressed that reserves could be formed at small trouble and expense in the engineers' shops, in the factories, in ironworks, in gas-works, and similar works throughout the country; which would assure to the Royal Navy the services of a large body of highly skilled engineers and firemen, who after a few weeks' service at sea would form efficient members of the crew. The subject has received much attention in the steam-shipping circles of Liverpool, as it is well-known that difficulty is experienced in obtaining efficient firemen for the Navy.

An important twelve days' sale of shipbuilding plant began in Liverpool on Monday, 19th of February, and will close on Tuesday, March 6th. The plant is that contained in the Toxteth Dock and Park Street building yards, which have been carried on for many years by Mr. Caleb Smith. Mr. Smith is having to relinquish possession of the yards owing to the Mersey Docks and Harbour Board requiring the sites for dock extension. The plant is catalogued into 2,630 lots, and comprises some large bending and drilling machines, and fitting-shop appliances. The whole are being sold by auction by Messrs. Thomas Whitehead and Sons, of Liverpool.

THAMES.

(From our own Correspondent.)

A NEW joint has been invented by Mr. Preschlin, the manager of Elmore's German and Austro-Hungarian Metal Co., which gets rid of the brazed joints, the source of so many failures in copper steam pipes. The part of the pipe most subject to strain is that of the joint between the flange and the pipe where the brazing has been made. The joint consists of two flanges, with the hole for the pipe conically turned, and of two conical plugs to fit on the inside of the pipe. The pipe is between the flange and the plug, and it is made bell-mouthed to receive the plug, which, after insertion into the end of the pipe, is lapped round the plug. The expanded end of the pipe is compressed between the plug and the flange, and then the flanges are driven home with bolts. The pipes were tested under a longitudinal strain by Messrs. D. Kirkaldy & Son. The pipes tested were one set about 4·346 in. and 4·145 in. outside diameter, and 3·95 in. and 3·938 in. inside diameter respectively. Fracture took place with the thicker pipes at a pressure of 30,000 lbs. per square inch, and with the thinner at 39,000 lbs. per square inch.

The Parsons steam turbine is by no means the only one in the field, although it is the most successful in its applications. But there is another one manufactured by Messrs. Greenwood & Batley, Limited, of Leeds, called the De Laval steam turbine. In its present form it is of the impulse type, and takes up the kinetic energy of the steam—kinetic energy of any mo body depending on the square of the speed, the higher the better. In some machines the speed is 30,0 these are small machines. In larger machines of about 200 H.P. the speed is 10,000 revolutions. These high speeds must necessarily be reduced for communicating motion to working machines, and this is done by double helical gearing. On machines up to 30 H.P. one gear is found sufficient, but in machines above 30 H.P., the pinion in the turbine shaft gears into two wheels on opposite sides, producing balanced strains. The reduction of speed is about 10 to 1. They have applied the motor to drive machinery by means of belts, and ropes to drive dynamos, the dynamos being placed on the second speed shaft; to turbine pumps, the pump being placed in the second speed shaft; to turbine exhaust and pressure fans. On a 300 H.P. steam turbine motor the consumption of steam was 13·9 lbs. per brake H.P.

Mr. A. F. Hills, of the Thames Iron Works must be a very busy man. Not long ago the old firm of John Penn & Sons, of Greenwich, was taken over by the company, and he naturally became managing director of that. But the valley of the Thames is not enough for Mr. Hills, and to be managing director of the largest shipbuilding yard, as well as one of the largest engineering shops, does not absorb his whole energies. He is also chairman of Messrs. Reavell & Co., of Ipswich. This firm is on the Admiralty list, and it has the orders in process of execution for 36 sets of fans and engines for three battleships. The engines of these battleships are being constructed by the Thames firm. Messrs. Reavell & Co. make an air compressor which has four compressing cylinders with trunk pistons, the connecting rods of which are actuated by a common crank. The suction parts of the cylinder are uncovered by the piston at the end of the stroke. The air is drawn from the crank chamber through the grid valve. A weighted lever is constantly tending to open the grid to its fullest extent, but it is controlled by a plunger in a cylinder connected with the receiver. When the receiver pressure rises the section is throttled. The cylinders are water jackets, and corrugated to assist the water in taking away the heat as rapidly as possible. The driving shaft may be actuated by means of engine electric motion or by belting.

We are having milling machines now to do almost everything in engineering work. The latest is one to cut screws. That Messrs. John Holroyd & Co. of the Perseverance Works, Milnrow, Rochdale, have brought out a new one will be of great interest to the managers of engineering works on the Thames and elsewhere, most of whom are fitting up their shops with the latest machine tools in order to allow them to successfully cope with their work and get it done in time. The machine cuts screws of any length, and up to 1¾ in. diameter. The great advantage which these milling machines offer is that they can be worked by men who are not necessarily classed skilled, and this, with the cutting of a screw which formerly required very skilled labour indeed, can be done in this machine by an unskilled worker. There was always a difficulty with threads produced in a lathe not being quite accurate. For one thing this was due to the cut not being taken all at one time, and that there was always a certain amount of backlash. Now with the milling machine, which takes the entire cut at once, there is no backlash, the nut on the screw being adjustable so as to take all backlash out of it. There is an advantage also from the cutter lasting much longer than the cutting tool. A cutter has been known to last without sharpening whilst it cut 30 1-in, screws 6 in. long.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow-in-Furness.—There is very little change to note in the shipbuilding industry in this district. The greatest possible activity is maintained, and every effort is being put forth to push forward the many important contracts on hand. These, as is known, are almost exclusively of the Admiralty class, and indeed the only commercial work on hand is that of repair orders, and they are not very numerous. The very bad weather experienced during the month has greatly retarded outdoor work, except in cases where men are employed under cover in the holds of ships and elsewhere. The severest snowstorm experienced in the district for thirteen years had to be contended with, and this led to the suspension of outside work for some days, but it happened at a time when the local volunteers were going out for active service, and under any circumstances the men would have taken a holiday at this time, not only from patriotic motives, but because they seem to find any excuse for a few days' leisure at any time, and this especially so when builders are very busy and when men are well off with plenty of money in their pockets, and with every prospect of good piping times for a long while to come. It seems to be one of the exigences of the shipbuilding trade that frequent holidays are indulged in. St. Lubbock is to some extent responsible for this. Time was when the Christmas and Whitsuntide holidays were the only playtimes recognised, now there are the Easter and the August bank holidays to be observed, and as many more as fate may decree. What with one holiday and another from five to six weeks out of every year are spent away from work, and, although the necessity is great for a change, there seems to be no remedy at hand.

The work in progress at the Naval Construction Works of Vickers, Sons & Maxim embraces the first-class British battleship *Vengeance*, which is being fitted up in the Devonshire Dock; the first-class armoured cruisers *Hogue*, *Euryalus*, and *King Alfred* the torpedo-boat destroyer *Vixen*, and the Japanese battleship *Mikasa*. The *Vengeance* has her engines and boilers in, both masts are stepped, and her general fittings are being proceeded with. She will be ready for her dock trials in the early summer of this year and by the autumn will, it is expected, be in the hands of the Admiralty. The *Hogue* is in a forward state. Her armour is being fixed, and she will be launched in the autumn. Her sister ship, the *Euryalus*, is next in order of progress, and will be ready for taking the water soon after the *Hogue*, but it will be next year before the *King Alfred* is launched. She will be the finest and largest cruiser ever built here, and will in addition to being strongly armoured, as well as protected, have a high rate of speed. Considerable energy is being employed in the construction of the Japanese battleship *Mikasa*, as the Japanese Admiralty require delivery as soon as possible, and in view of the possible entanglement with Russia this is quite easy to understand, but eighteen months under the most favourable conditions must elapse before she can be completed and ready for service. The first ship to be launched at Barrow will be the torpedo-boat destroyer *Vixen*, and it is expected she will give a very good account of herself, as the experience the firm have now had will enable them to fulfil the very exacting conditions of these frail craft with much less trouble and with more certainty and expedition than was previously possible. It takes some time and experience to enable builders and engineers to tackle this work successfully, but when once they have been through the mill they are able to bring valuable experience to the aid of economic production, and to the celerity with which they can complete the contracts undertaken. Take the case of the *Leopard*, the seventh torpedo boat built at Barrow, and the last delivered to the Admiralty, is a striking proof of this. She went through most exacting trials without a single hitch, and she is admitted to be the crack torpedo-boat destroyer in the Devonport flotilla. Only recently in a spin from Belfast to the English Channel she beat all her sister ships, and even when the flotilla were under easy steam with three of their boilers going, the *Leopard* outdistanced them all, although she had only two boilers in steam. The admiral in command of her signalled her back, and, leaving his flagship, went on board the *Leopard*, and proceeded with her home in order to see for himself how she managed to do better than her sister craft, with 33 per cent. less boilers at work. He was eminently satisfied with her performance. This is a feather in the cap of the Thornycrofts, whose boilers, built at Barrow, are used in this torpedo-boat destroyer. The *Otter*, another Barrow-built torpedo-boat destroyer, which gave some trouble to her builders, is now in commission, and is giving almost equal satisfaction to the *Leopard*. The *Sturgeon*, *Skate*, *Starfish*, *Bittern*, and *Avon*, torpedo boat destroyers, built at Barrow, are highly spoken of by the Admiralty officers in charge of them. It is evident that Messrs. Vickers, Sons & Maxim have made for themselves a good name as builders of these light but fast and highly destructive little ships. But to the experience gained in the construction of these craft must be added the fact that they are fitted in their engine rooms with shafts and other working parts made of Vickers steel, which has been proved the most reliable and trustworthy.

The marine engineering department of Messrs. Vickers's works at Barrow is very fully employed; indeed, there is a perfect congestion of work in progress, but it is passing through at a very satisfactory rate, and will be ready for the several ships in progress of construction when they are ready to be fitted with their engines, main and auxiliary, their Belleville and other boilers, and other mechanical fittings. This department is undergoing a process of very considerable extension in every branch. New iron and steel foundries are springing into existence, all of them of considerable size and constructed on the most modern lines. A new brass foundry, new electric power works, and a dozen minor establishments are springing into life, with the ultimate result that the works will soon double their size and have double the capacity of production in the point of tonnage of ships launched and I.H.P. constructed, that they were when Messrs. Vickers, Sons & Maxim took over the concern a couple or three years ago. There is no stint in capital expenditure, but the money in all cases is being very wisely spent, and the best practical and expert opinions are guiding the directors in this work of extension. Already a vast increase in the number of men employed is noticeable, and this increase is showing itself more and more every day.

The gun-mounting business at the Naval Construction Works is becoming a very important department. The great bay, originally erected for this purpose, has been twice enlarged already, and a third and considerable enlargement is now in progress of construction, and even then the department will not be nearly large enough for the work it has to do, and arrangements are therefore almost completed whereby the present capacity of the department will be more than doubled. At present over 200 machines are at work in the various details of gun mounting, and it is probable ere long more than double that number will be in operation. Over 1,500 men are now employed in gun mounting operations at Barrow. In a couple of years it is anticipated that over 3,000 men will be employed, because not only is there a big rush of naval work, not only have the firm *carte blanche* from the Admiralty and other sources to build guns for naval purposes, but they have now to face the necessity, thanks to the Transvaal War, of building big siege guns and heavier garrison and field guns than are at present in use by the British artillery. This is destined to be a very big department at the Naval Construction Works, and there are those who share the opinion that in the sweet-by-and-by not only will gun mountings be produced at Barrow, but guns as well, for the steel of which they are made is produced in the town, and the port of Barrow gives cheap facilities for shipment, not only to British ports, but to the countries of the world.

With this view it is interesting to know that the dock sill at Barrow is being deepened, so that vessels of 30 ft. draught can ride safely in the docks, and vessels of 100 ft. beam can safely be berthed. This work of dock improvement will be completed during the summer months, and it is quite on the cards that subsequently a big graving dock of great length and depth, capable of docking the largest ship ever built, or ever likely to be built, will be provided at Barrow.

Messrs. Vickers, Sons & Maxim some time ago contracted to build the engines for the Spanish cruiser *Estremadura*, but let off the work to an engineering firm at Barcelona, who have worked from the Barrow designs. The Belleville boilers for the ship have been constructed at Barrow, and will be shipped to Spain. The Barrow firm are responsible for the speed results of the ship on her trial trip.

West Cumberland.—The shipbuilding industry in West Cumberland is very brisk, and orders are plentiful. Both the yard at Maryport and the one at Workington are full of work, and likely to be for some time; indeed, orders are more plentiful than builders can undertake, and as they confine themselves to the building of small craft, this may be taken as a proof that, whilst the general movement is in the direction of building very large steamers, there is still a very full and healthy demand for comparatively small ships. Very few sailing ships have been built in recent years in West Cumberland, and it is probable no more will be built, as the big cargo steamers now entering all long sea trades are crushing the old type of sailing vessel out of existence.

Shipbuilding Material.—A marked improvement has arisen in the demand for shipbuilding material, and the makers in this district are not only very busily employed, but they are in receipt of inquiries which could only be justified by a very brisk demand for new shipping tonnage. Ship plates have advanced to £8 2s. 6d. and £8 3s. 9d. per ton net at works or f.o.b.; boiler plates are at £9 15s. All classes of shipbuilding material are in full request, and the mills in every department are kept busily employed, and are likely to remain so for an indfinite length of time.

Hematites.—The hematite pig-iron trade is very active, and the market has undergone a change for the better during the month, especially as regards warrant iron. This was depressed owing to a variety of causes, which have been proved unfounded, and now, when stocks are being depleted in order to meet a heavy demand for prompt deliveries, prices are advancing, and are now at 77s. 6d. net cash sellers, buyers one penny less. Makers are very firm at 80s. to 82s. per ton for mixed Bessemer Nos. net free on board. During the month stocks have been reduced considerably, and now stand at 170,085 tons, or 11,976 tons less than at the beginning of the year. There are 47 furnaces in blast as compared with 40 in the corresponding week of last year.

Shipping.—The shipping trade is very well employed, and freights are very satisfactory. The exports of pig iron since the beginning of the year have reached 114,581 tons, and of steel 54,078 tons, being an increase of 53,721 tons of pig iron, and a decrease of 17,348 tons of steel, as compared with the corresponding period of last year.

Workmen's Houses.—There is still a great scarcity of houses for workmen in Barrow, owing to the growth of Barrow industries, and the increased and ever-increasing number of men employed. Messrs. Vickers are building several hundred houses on Walney Island, near their works, and private builders are putting up several hundreds of new houses in the town proper, but there is immediate need of fully 1,000 additional houses at the present time, to say nothing of what will evidently be required in the early future.

Miscellaneous.

Electric Canal Haulage has received another step forward by Siemens & Halske. They have been making experiments with barges on the Finon Canal with two different systems. One is a kind of telphorage motor, the other is an electrical locomotive which runs along the tow-path on plain rails. In the first system the motor is suspended on rods supported on posts, and the current is supplied to it by means of a separate wire. There are great difficulties in this case, due to accidents due to the great strain produced by the motor. In the other case the traction wheels on the rail support 85 per cent. of the weight of the locomotive, the other wheels run on a light rail, or in the ground tow-path. The highest speed is three miles per hour, and the traction force 12 cwt. A series motor is used, which allows of a higher speed when running light.

Japanese Launches.—Messrs. Mitsubishi Zosenjo, of Nagasaki, Japan, launched the following vessels during 1899:—Three steel twin-screw steamers, each fitted with a twin set of triple-expansion engines: the *Awa Maru*, 6,309 tons gross register, 4,112 I.H.P.; the *Bakan Maru*, 320 tons gross register, 320 I.H.P.; the *Toyora Maru*, 322 tons gross register, 346 I.H.P. A single-screw steel steamer, the *Akunoura Maru*, 1,630 tons gross register, fitted with triple-expansion engines of 900 I.H.P. Also two bucket-dredgers of 130 ft. and 120 ft. long, one first-class torpedo boat of 120 tons and two second-class torpedo boats of 82 tons (these were sent out in pieces from Europe and reinstated in Messrs. Mitsubishi Zosenjo's yard). Besides these six wooden steam launches, each of 45 ft., were launched and completed.

John Hopkinsom Memorial.—The inauguration of a new wing to the engineering laboratory at Cambridge University, which is the gift of the widow of Professor Hopkinson took place on the 2nd February. The sum handed over by the widow, son, and daughter for this purpose was £5,000. The wing is a block 92 ft. long and 40 ft. wide, mostly of three storeys and built alongside the old engineering laboratory. In the building is a lecture theatre, a class-room, a large laboratory for testing the materials, and for hydraulic experiments, a dynamo room, and several small rooms. Prominent engineers assisted in the memorial, to the extent of £1,200, to properly fit the place with apparatus, and gifts of further apparatus have been given. A testing machine has been presented by past and present students of Dr. Hopkinson. A portrait of Dr. Hopkinson was unveiled in the lecture theatre by the Vice-Chancellor, and Lord Kelvin delivered the inaugural address. The Vice-Chancellor explained that of the total cost—£12,500—no less than £11,000 had been contributed by donors. Lord Kelvin said he was the Senior Wrangler of 1871, and since then he had largely added lustre to the long roll of distinguished men who had won the highest honour with which this mathematical university annually crowned the career of one of its undergraduates. He had the rare power of grasping a high scientific truth
applying it practically to mechanical art for the u
kind. This was splendidly illustrated in the
did in improving the dynamo. Hopk
light was now in use in lighthouses all

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Kielder Castle.—On January 16th there was launched at Willington-Quay-on-Tyne for the Castle Trawl and Line Fishing Co., Limited, of North Shields, a steel steam ketch of about 128 tons gross, named the *Kielder Castle.*

Cymodocee.—On January 16th there was launched at Sunderland for A. C. Le Quellec, of Algiers, a steel schooner-rigged steamer, of about 3,810 tons gross, named the *Cymodocee.*

King William.—On January 18th there was launched at Grimsby, for the Monarch Steam Fishing Co., Limited, of Grimsby, a steel steam trawler of about 160 tons gross, named the *King William.*

Livingstone.—On January 19th there was launched at Hull, for the National Steam Trawling Co., Limited, of Hull, an iron steam ketch, named the *Livingstone.*

Ranee.—On January 20th there was launched at Hull from the yard of Earle's Shipbuilding Co. a steam trawler, built to the order of Mr. Ernest Sleight, of Grimsby. The vessel is 110 ft. long by 21 ft. beam by 11 ft. 3 in. moulded depth, and will be fitted with engines of the triple compound type, having cylinders 11 in., 20 in., and 32 in., by 23 in stroke, supplied with steam by a large steel boiler working at 180 lbs. pressure. The christening ceremony was performed by Miss Dorothy Downing, the vessel being named the *Ranee.*

Banca.—On January 20th there was launched from Messrs. Doxford & Sons, Limited, Pallion Shipyard, the large turret vessel *Banca.* Her dimensions are:—Length, 440 ft.; breadth, 51 ft. 6 in.; and depth, moulded, 32 ft.; whilst her deadweight capacity on 24ft. 9 in. is 8,080 tons. The vessel is fitted throughout with 'tween and lower decks, numerous derricks, and powerful winches, provided for rapidly handling cargo. The steamer is classed with British Corporation. Although the 55th turret afloat, it is the first vessel of this type built for the Peninsular and Oriental Steam Navigation Co., and she is in all respects up to the highest standard required by the company in their fleet. The engines, with cylinders, 27½, 45½, and 75 in. by 54 in., and three boilers, 15 ft. 2 in. by 11 ft. 9 in. long, are also by the builders.

Connie and **Kathleen.**—On January 22nd there was launched by Earle's Shipbuilding Co., at Hull, for the Fleetwood Steam Fishing Co., Limited, two steam trawlers named the *Connie* and *Kathleen.*

Steam Dredger.—On January 29th Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited, launched from their Walker shipyard the first of four suction dredgers they are at present building from the designs of Mr. Lindon W. Bates. The vessel in question is for the Port Improvements Commission of Calcutta. She is a steel screw hydraulic suction dredger of the following dimensions, viz.:—Length, 128 ft.; beam, 30 ft.; depth, 8 ft. 9 in. The dredger will be fitted with dredge, pumping, and propelling machinery manufactured by the Wallsend Slipway and Engineering Co.

Cambrian and **Bostonian.**—On January 29th there was launched at North Shields for the Boston Steam Fishing Co., Limited, of Boston, two steel steam ketches of about 190 tons gross each, named the *Cambrian* and *Bostonian.*

Minerva.—On January 30th there was launched at South Shields for the Vedra Steam Fishing Co., Limited, of Sunderland, a steel steam ketch named the *Minerva.*

Marburg.—On Wednesday, January 31st, Messrs. Furness, Withy & Co., Limited, launched from their Middleton shipyard, Hartlepool, a large steel screw steamer, built to the order of Messrs. the Norddeutscher-Lloyd, of Bremen, Germany. She is over 400 ft. in length, and built throughout of Siemens-Martin steel, with a measurement capacity of about 12,900 tons. The vessel is of the three-deck type, with long poop and forecastle, and takes Lloyd's highest class. The holds are fitted for wood shifting boards, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. The greater portion of the shell plates are in 24-ft. lengths. Eleven steam winches, donkey boiler, patent steam-steering gear, with hand-screw gear fitted aft, direct steam patent windlass, 14 derricks, six large cargo hatches, and other modern appliances are fitted for the handy working of the ship. Cellular double bottom is fitted all fore and aft, and the fore and after peaks are also available for water ballast. An extra number of bulkheads are fitted, making the vessel practically unsinkable in the event of collision at sea. A large hold is fitted just aft of the engine-room for the carriage of camphor, and the vessel is fitted up in the 'tween decks forward for Chinese passengers. The vessel will be lighted throughout by electricity, and the saloon and cabin, for the accommodation of the captain and officers of the ship, are handsomely finished. She will be rigged as a two-masted fore-and-aft schooner. Triple-expansion engines will be fitted by Messrs. Sir Christopher Furness, Westgarth & Co., Limited, Middlesbrough, having cylinders, 28 in., 44 in., 75 in. by 48 in. stroke, steam being supplied by two boilers, 14 ft. long by 12 ft., and one 15 ft. 5 in. by 12 ft., working at a pressure of 180 lbs., Howden's forced draught being also fitted. This vessel is a duplicate of the *Freiburg*, now being completed at Messrs. Furness, Withy & Co.'s yard for the same owners. On leaving the ways the ceremony of christening the vessel *Marburg* was gracefully performed by Mrs. R. Dahl, wife of the superintendent for the owners.

Skipsea.—On January 31st Messrs. William Gray & Co., Limited, launched the large steel screw steamer *Skipsea*, which they have built to the order of Messrs. William Brown, Atkinson & Co., Limited, of Hull, for the Sea Steamship Co., Limited. Her principal dimensions are:—Length over all, 336 ft.; breadth, 47 ft.; and depth 24 ft. 10 in., and she is built to Lloyd's highest class, with poop, bridge, and forecastle, and fore-and-aft schooner rig. Very tasteful cabin accommodation is provided in a large deck-house on the bridge. The engineer's rooms are also on the bridge, and the crew's accommodation forward. The hull is built with deep frame and a cellular double bottom and after peak tank for water ballast, steam windlass, steam-steering gear amidships, hand-screw gear aft, six steam winches; and the whole of the outfit is of the most approved description. The engines are by the Central Marine Works of Messrs. William Gray & Co., Limited, on the triple-expansion system, with cylinders 24 in., 38 in., and 64 in. diameter, and 42 in. piston stroke, and three single-ended main boilers to work at 160 lbs. pressure per square inch. The ship and machinery have been built under the superintendence of Messrs. J. Jamieson & Co., on behalf of the owners. The ceremony of naming the *Skipsea* was gracefully performed by Miss F. Fenton, daughter of Mr. E. Fenton, one of the directors. The following were also present at the launch, viz.: Mr. Joseph Atkinson (chairman of the Sea Steamship Co., Limited), Mr. and Mrs. Arthur Atkinson, Mr. E. Fenton, Miss B. Fenton, Mr. Jenkins (principal of Messrs. J. Jamieson & Co.), and Captain Blenkarn, who will take command of the steamer.

King Haakon.—On February 1st there was launched at Selby for the Viking Steam Fishing Co., Limited, an iron steam ketch named the *King Haakon.*

Atlas.—On February 1st there was launched at Bill Quay, Newcastle-on-Tyne, by Messrs. Wood, Skinner & Co., Limited, a handsome steel screw steamer of the following dimensions, viz.:—Length, 248 ft.; breadth, 35 ft.; and depth, moulded, 20 ft. 6 in., which has been built to the order of Messrs. Eyde & Hein, of Arendal, Norway. The vessel is of the improved single-deck type, with bridge and topgallant forecastle, and has been constructed under special survey for Lloyd's 100 A1 and also Norwegian Veritas 100 A1* classifications. The saloon, captain's accommodation, and spare berths are in a large house on the bridge deck amidships, having chart-room and wheel-house on flying bridge above, the officers' and engineers' accommodation being in side houses amidships, whilst the crew are berthed in the topgallant forecastle. Water ballast is provided in the cellular double bottom all fore and aft, and in the after peak. She will be rigged as a fore-and-aft schooner with telescopic topmasts, and will be fitted with all the most modern description of deck machinery and other appliances for facilitating the rapid loading and discharging of cargo and general working and navigation. The propelling machinery has been constructed and will be fitted by the North-Eastern Marine Engineering Co., Limited, at the Northumberland Engine Works, Wallsend-on-Tyne, and will consist of a set of triple-expansion engines of the improved type, having cylinders 18½ in., 30 in., and 49 in. in diameter, with a stroke of 33 in., steam being supplied by a large steel multitubular boiler, working at 160 lbs. pressure per square inch. The machinery has also been constructed to the requirements, and under the special survey of both Lloyd's and the Norwegian

Veritas for their respective highest classification. The ceremony of christening the vessel was performed by Miss Josephine Jacobsen, of Grimstad, Norway, niece of Captain Jacobsen, who named her *Atlas*.

Sevilla.—On February 1st there was launched at Sunderland by Messrs. J. Priestman & Co. a screw steamer, built to the order of Messrs. A. C. de Freitas & Co., Hamburg, for their Argentine and Canadian cattle trade. The principal dimensions are:—Length, 410 ft.; breadth, extreme, 52 ft. 2 in.; depth, moulded, to shelter deck, 38 ft. 7 in.; having a total displacement of about 11,000 tons. This vessel is to take the highest class, 100 A1, at Lloyd's, being built to the three-deck rule, with shelter deck. The engines and boilers will be supplied by Messrs. T. Richardson & Sons, of West Hartlepool. Miss R. Willson, Enfield, Gateshead, named the vessel *Sevilla*.

Zillah.—On February 1st there was launched at Sunderland by Messrs. Bartram & Sons a large steel screw steamer for Messrs. Brightman & Co., of London. She is of the spar-deck type, with poop, long bridge, and topgallant forecastle, and is of the following dimensions:—Length, 340 ft.; breadth, 48 ft. 6 in.; depth, moulded, 28 ft. 6 in. She has been built to take the highest class at Lloyd's registry, under the supervision of Captain Sutton on behalf of the owners. The engines will be supplied by Messrs. Blair & Co., of Stockton, the cylinders being 24 in., 43 in., and 66 in., with a stroke of 45 in. The christening ceremony was performed by Mrs. Turner (wife of the managing owner), who named the vessel *Zillah*.

Kensington.—On February 1st Messrs. Cochrane & Cooper, Limited, launched from their Grovehill Shipyard, Beverley, a new steam trawler of the following dimensions: 100 ft. by 21 ft. by 11 ft. depth of hold, built to the order of the Queen Steam Fishing Co., Limited, Grimsby. Triple-expansion engines are being fitted by Messrs. J. Cran & Co., Leith, and the vessel will be fitted out ready for sea with all modern appliances for trawling. Miss Southern, of Grimsby, named the vessel s.s. *Kensington*, and after the ceremony the company adjourned to the Beverley Arms for breakfast. Amongst the company were Mr. Osborne, of the Queen Steam Fishing Co., Limited, and also Messrs. Strickland and Southern, of Grimsby.

Osmo.—On February 2nd Messrs. Craig, Taylor & Co launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a fine steel screw steamer of the following dimensions, viz.: 254 ft. by 37 ft. by 18 ft. depth, moulded; raised quarter-deck type, with bridge and topgallant forecastle, the bows being specially strengthened for ice. The vessel has been built to the highest class in Lloyd's under special survey, and is constructed to carry about 2,150 tons deadweight on a light draught of water. She has water ballast in double bottom fore and aft, and in peak. She has large cubic capacity, and is equipped with four double-powered steam winches, patent direct steam windlass, patent steam-steering gear amidships, screw gear aft, large donkey boiler, and all the latest improvements for expeditious loading and discharging. The engines have been constructed by Messrs. MacColl & Pollock, of the Wreath Quay Engine Works, Sunderland, the cylinders being 18½ in., 30 in., 49 in., by 33 in. stroke, with two large steel boilers working at 160 lbs. pressure. This vessel has been built to the order of the Bjorneborgs Angfartygs Aktiebolag Porin Hoyrylaiva Osakeyhtio (Mr. Oscar Heine, manager), under the superintendence of Mr. George Jaques, Newcastle, and Captain Wikstrom. As the vessel left the ways, she was gracefully christened the *Osmo* by Mrs. Elliott, of Newcastle.

Puritan.—On February 3rd there was launched at Hull for G. Walton, of Hull, an iron steam ketch named the *Puritan*.

Lizzie.—On February 6th there was launched by the Selby Shipbuilding Co., at Selby, for Sir Christopher Furness, the steam trawler *Lizzie*.

Zeila.—On February 8th there was launched by Messrs. J. P. Rennoldson & Son, at South Shields, an iron screw tug, of the following dimensions: 75 ft. by 17 ft. 6 in. by 10 ft. moulded. The engines are of the compound surface-condensing type, of 250 I.H.P., and will be fitted by the builders. She is built to the order of the Peninsular and Oriental Steam Navigation Co., London, and intended for service in connection with their line at the port of Aden. The vessel was named the *Zeila*.

Charlotte.—Lately Earle's Shipbuilding Co. launched at Hull a large steam trawler, built to the order of Messrs. A. & G. Vidor Fils, of Boulogne-sur-Mer. The vessel is 126 ft. long by 22 ft. beam by 12 ft. moulded depth, and will be fitted with triple-expansion engines having cylinders 13 in., 22 in., and 36 in. by 24 in. stroke. The trawler was named *Charlotte*.

Briardale. — On February 15th Messrs. Short Brothers launched from their shipbuilding yard at Pallion a handsomely modelled steel screw steamer, built to the order of Messrs. G. H. Elder & Co., of Newcastle-on-Tyne. The vessel has been built under special survey to the highest class in Lloyd's register, and is of the following dimensions, viz.:—Length, 327 ft.; breadth, 42 ft.; and depth, moulded, 26 ft. 9 in.; and is of the strengthened spar-deck type. The vessel is fitted with a full poop, long bridge amidships (on which houses are fitted up for the accommodation of the captain and officers), and topgallant forecastle for crew. There are four large hatchways, with a powerful steam winch at each, steam being supplied to the latter by a large multitubular donkey boiler placed in the stokehold. The double bottom, which is on the cellular principle, is subdivided into trimming tanks for water ballast. On leaving the ways the vessel was named *Briardale*, the ceremony being gracefully performed by Miss Mildred Cail, of Newcastle-on-Tyne. The vessel is to be fitted with triple-expansion engines by Messrs. the North-Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 23 in., 38 in., and 62 in. by 42 in., with two boilers 14 ft. 6 in. by 10 ft. 6 in., 160 lbs. pressure. The construction of the vessel has been under the supervision of Captain Fothergill, who will take command on completion.

Rosario.—On February 16th the Blyth Shipbuilding Co., Limited, launched from their shipbuilding and graving dock works at Blyth a steel screw steamer, built to the order of Messrs. Orders & Handford, Newport (Mon). The dimensions of this vessel are:—Length, 282 ft.; breadth, 40 ft. 9 in.; depth, 20 ft. 6 in., and is built to class 100 A1 at Lloyd's, on the single-deck principle, with deep frames. The saloon and captain's cabin are arranged for in house on bridge, whilst the accommodation for the officers and engineers is under bridge, and the crew in topgallant forecastle. The equipment includes stockless anchors, powerful steam winches, large donkey boiler, steam windlass with quick warping gear, steam-steering gear, and all the latest appliances for the quick and economical working of the vessel. Triple-expansion engines of good power will be supplied and fitted by Messrs. J. Dickinson & Sons, Limited, of Sunderland. As the vessel left the ways she was named *Rosario* by Miss James, of Swansea. The hull and machinery have been constructed under the inspection of Mr. Boddy, superintendent engineer, of Newport.

Ventmoor.—On February 16th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length, between perpendiculars, 330 ft. 6 in.; breadth, extreme, 46 ft. 6 in.; depth, moulded, 27 ft. The steamer has been built to the order of Messrs. Walter Runciman & Co., of Newcastle-on-Tyne. The vessel is built on the three-deck rule, with one deck laid, having full poop, long bridge, and topgallant forecastle. The saloon and cabins for the captain and officers will be fitted up in the poop, the accommodation for engineers under the bridge deck, and the crew will be berthed in the forecastle as usual. She has double bottom for water ballast on the cellular principle, fore and aft, and in large after peak tank. The vessel will carry about 5,600 tons deadweight on Lloyd's freeboard, is fitted with direct steam windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft, and five large steam winches supplied with steam from two donkey boilers, the outfit generally being liberal and fully up to date. She will be fitted with a set of triple-expansion engines by Messrs. Blair & Co., Limited, of about 1,200 I.H.P., steam being supplied by two steel boilers 15 ft. 3 in. by 10 ft. 6 in., steam pressure being 160 lbs. per square inch. The christening ceremony was gracefully performed by Miss Ropner, of Preston Hall, who gave the vessel the name of *Ventmoor*.

LAUNCHES—Scotch.

Montenegro.—On January 20th there was launched at Port-Glasgow for Montenegro, Ferreira & Co., of Para, a steel schooner-rigged steamer, of about 417 tons gross, named the *Montenegro*.

Agamemnon.—On January 23rd there was Greenock, by Messrs. Scott & Co., a screw steaming dimensions, viz.: 440 ft. by 52 ft. 6 in. by 35 ft., moulded; gross displacement, 13,410 tons; deadweight, 8,775 tons; gross tonnage, 6,800 tons. The vessel is fitted with triple-expansion engines, constructed by the builders, having cylinders 29 in., 50 in., and 82 in. diameter by 5 ft. stroke, and 4,500 H. P., giving a sea speed of 13 knots. The vessel has been specially designed for the Ocean Steamship Co.'s line of China steamers. The christening ceremony was performed by Mrs. George Holt, who named the vessel *Agamemnon*.

Clan Maclachlan.—On February 29th Messrs. Alexander Stephen & Sons launched a steel screw steamer of the following dimensions: 395 ft. by 48 ft. by 30 ft., for the Clan Line. The vessel is built in excess of Lloyd's requirements for 100 A1 three-deck class, and is fitted with engines having cylinders 25 in., 41 in. and 67 in. diameter by 48 in. stroke; and boilers 15 ft. 6 in. diameter by 11 ft. 6 in. long, with Howden's forced draught, and suitable for 200 lbs. pressure. The steamer will carry close on 7,000 tons deadweight. Her auxiliary machinery and cargo appliances are very complete and of the most approved type. The vessel is the seventeenth built by Messrs. Stephen for the Clan Line, and she was gracefnlly named the *Clan Maclachlan*, by Miss Maclachlan, of Dunrowan, Dumbreck, Glasgow.

Kilbroney.—On January 30th the Irvine Shipbuilding and Engineering Co., Limited, Irvine, launched a steel screw steamer of 320 tons deadweight, to the order of the Clanrye Steamship Co., Limited, Newry. The vessel has been built to Lloyd's highest class under special survey for the owners' coasting trade, her dimensions being 135 ft. by 21 ft. 6 in. by 11 ft. 9 in. moulded. Mr. W. V. V. Lidgerwood, Coatbridge, is supplying the machinery, the engines being of the compound surface condensing type, having cylinders 17½ in., and 40 in. by 27 in. stroke, steam being supplied from a large steel boiler at 140 lbs. working pressure. The vessel on leaving the ways was gracefully named *Kilbroney* by Mrs. Sneddon, Claremont, Irvine.

Shinano Maru.—On January 30th there was launched from the shipbuilding yard of Messrs. David and William Henderson and Co., Partick, a handsomely modelled twin-screw steamer, which has been built to the order of the Nippon Yusen Kaisha, of Tokio. This vessel, which is similar, but with increased first-class passenger accommodation, to the five steamers completed by the builders some little time ago for the same owners, has been built under the supervision of Mr. A. R. Brown, Japanese Consul at Glasgow, and Mr. George McFarlane. Her principal dimensions are:—Length over all, 463 ft.; beam, moulded, 49 ft. 2 in.; depth, moulded, 33 ft. 6 in.; and a gross tonnage of about 6,000. She is classed in Lloyd's 100 A1 three-deck rule. A most complete installation of electric light by Messrs. W. C. Martin & Co., Glasgow, is being fitted throughout the vessel, Napier Brothers' capstan windlass, and Caldwell's steam-steering gear. The machinery will be supplied by the builders' firm, and consists of two sets of triple-expansion engines, each having cylinders, 20 in., 33½ in., and 56 in. diameter, by 48 in. stroke. Steam is supplied by two large double-ended and two single-ended boilers, constructed for a working pressure of 200 lbs. per square inch. On leaving the ways the vessel was gracefully named *Shinano Maru* by Mrs Negishi, wife of the Japanese manager of the company in London.

Esles.—On January 31st Messrs. Robert Duncan & Co. launched at Port-Glasgow a steel screw steamer of 1,900 tons gross register, to carry 3,100 tons deadweight. Dimensions: length, 280 ft.; breadth, 40 ft.; depth, 20 ft. 6 in. The steamer is named *Esles*, and was built to the order of Messrs. Constantine, Pickering & Co., Middlesbrough, and has since been transferred to Mr. F. G. Camino, jun., Santander. Messrs. Dunsmuir & Jackson, Glasgow, will supply the machinery.

Invernia and **Ben Attow.**—On February 1st two trawlers were launched by Messrs. Hall, Russell & Co., at Aberdeen, for the Irvine Steam Fishing Co., Limited, North Shields, and the North British Steam Fishing, Co., Limited, Aberdeen. The vessels, which were named respectively the *Invernia* and the *Ben Attow*, are 150 tons gross register, and are fitted with boiler and triple-expansion engines of 320 I.H.P.

Drumblade.—On February 1st there was launched at Montrose a steel steam ketch of about 196 tons, named the *Drumblade*, for the Aberdeen and North of Scotland Steam Fishing Co., of Aberdeen.

Planet Venus.—On February 3rd Messrs. Napier & Miller, Limited, launched at Yoker, on the Clyde, the steel screw steamer *Planet Venus* for Messrs. R. W. Leyland & Co., of Liverpool. Her dimensions are:—Length between perpendiculars, 385 ft.; breadth, moulded, 48 ft. 6 in.; depth, moulded, 29 ft. 9 in.; having a deadweight carrying capacity of about 7,000 tons, and a gross tonnage of 4,400 tons. The vessel is built to the highest class of the British Corporation, with cellular double bottom, all fore and aft; also after peak for water ballast. The vessel is fitted with two pole masts, and is fore and aft schooner-rigged. Her machinery is being supplied by Messrs. Dunsmuir & Jackson. Engines triple-expansion, with cylinders 27 in., 43 in., and 72 in., with 48 in. stroke; two boilers of large size, with a working pressure of 180 lbs. During construction the hull and machinery have been under the personal supervision of Messrs. Maxton & Sinclair, consulting engineers, Liverpool, and Captain J. W. Kelly, of Messrs. Leyland, who will take command of the vessel when finished. The christening ceremony was performed by Mrs. Preston, wife of Mr. Arthur J. Preston, one of the partners of Messrs. R. W. Leyland & Co.

Ern.—On February 5th there was launched at Aberdeen, for D. Sherrit, of Aberdeen, a steel steam ketch of about 182 tons, gross, named the *Ern*.

Sirius.—On February 12th there was launched at Port-Glasgow, by Messrs. Russell & Co., the steel screw steamer *Sirius*, 5,500 tons deadweight carrying capacity, for French owners. Dimensions: length, 330 ft.; breadth, 38 ft.; depth, 26 ft. Messrs. Kincaid & Co., Greenock, will supply the engines.

Portadown.—On February 13th there was launched at Paisley, by Messrs. John Fullerton & Co., a steel screw steamer of about 350 tons, which has been built to the order of Messrs. Joseph Fisher & Sons, Newry, for their coasting trade. The steamer is largely in excess of Lloyd's requirements, and has the most modern outfit for working both ship and cargo. Compound engines of 450 I.H.P. are being supplied by Messrs. Hall-Brown, Buttery & Co., Govan. The steamer was named *Portadown* by Mr. Edward Connolly, engineer, Newry, under whose superintendence it has been built.

Gladys.—On February 15th there was launched at Bowling by Messrs. Scott & Sons a screw steamer of the following dimensions: 95 ft. by 21 ft. 6in. by 10 ft. 6in., moulded, which they have built to the order of Messrs. Joseph Monks & Co., Limited, Warrington. Compound surface condensing engines are to be fitted on board by Messrs. Ross & Duncan, Govan. On moving down the ways the steamer was named *Gladys* by Miss M. Gladys Thomas, Brou Avon, Cressington Park, Liverpool.

Tugela.—On February 19th there was launched at Port-Glasgow by Messrs. A. Rodger & Co. the steel screw steamer *Tugela*, for Messrs. Maclay & Macintyre, Glasgow. The dimensions are:—Length, 326 ft.; breadth, 48 ft.; depth, 26 ft. 4½ in. This steamer will carry 5,600 tons deadweight. Messrs. Hall-Brown, Buttery & Co., Glasgow, will supply the machinery.

Saturn, Jupiter, and **Mercury.**—On February 19th there was launched at Govan by Messrs. Mackie & Thomson, the steam trawlers, *Saturn*, *Jupiter*, and *Mercury*, which they have built for the Grimsby and North Sea Steam Trawling Co. The dimensions of each are:—Length, 108 ft. between perpendiculars; breadth, 21 ft.; depth, 12 ft.; tonnage, 180 gross. Triple-expansion engines of 400 I.H.P. will be supplied by Mr. W. V. V. Lidgerwood, Coatbridge. The vessels, which were named by Miss Alward, Miss Cook, and Miss Richards, Grimsby, are the first three of an order for six of the same type, and make 22 which the firm have built for the same owners.

Sappho.—There was launched from the yard of Ramage & Ferguson, Limited, a steel screw steamer, built to the order of the Bristol Steam Navigation Co, Limited, for their general trade between Germany and Bristol. The following are the principal particulars of the new vessel:—Length between perpendiculars, 230 ft.; breadth, 33 ft.; depth, moulded, 17 ft. 4 in. Triple-expansion engines, having cylinders, 18 in., 27½ in., 45 in. diameter, by 33 in. stroke, steam being supplied from a large boiler working up to 160 lbs. pressure. The vessel is supplied with steam windlass, steam-steering gear, steam cranes, and all the most modern improvements for the rapid handling of cargo. The vessel was named *Sappho* by Mrs. John T. Ramage, St. Aubyns. The builders afterwards entertained a large company to lunch, when the usual toasts were honoured.

TRIAL TRIPS.

Hercules.—On January 23rd the steamship *Hercules*, built by Messrs. R. Craggs & Sons, Middlesbrough, to the order of Mr. John Lockie, of Newcastle-on-Tyne (of which we gave particulars in our January issue, page 476), had her trial trip off the mouth of the Tees. Owing to the fog and haze on the water, it was not deemed prudent to drive the vessel at full speed; but on a run seaward for over an hour, under easy conditions, she travelled at the rate of ten knots per hour, which speed was considered highly satisfactory under the circumstances.

Gelderland.—On January 24th the steamer *Gelderland*, recently launched by the Blyth Shipbuilding Co., Limited, of Blyth, was taken to sea for her official trial trip. The vessel, which was built for the Lombard Steamship Co. of London, has been transferred to the Scheepvaart en Steenkolen Maatschappy of Rotterdam. Her principal measurements are as follows:—Length, 259 ft.; beam, 37 ft.; and depth, 18 ft. She is of the raised quarter-deck type, and has been built to Lloyd's highest class. The cabins for captain, officers, and engineers are fitted in iron houses on bridge, and the crew are berthed in topgallant forecastle. The deck machinery is of the latest type for the quick and safe working of the vessel and her cargo. The engines and boilers have been supplied and fitted by Messrs. MacColl & Pollock, of Sunderland, the cylinders being 20½ in., 33 in., and 54 in., with a stroke of 36 in. and 170 lbs. pressure. Amongst those on board were Mr. Horstmann, one of the directors of the steamship company, Captain Schmidt, and Mr. Bagallay, of the firm of Messrs. Flannery, Bagallay & Johnson, of London, Mr. Stenhouse, of Newcastle, and others. After adjusting compasses various trials of speed were made over the measured mile, with gratifying results. After the trial the vessel was taken to the Tyne, where she will load and proceed to Antwerp under the command of Captain F. O. Peters.

Nina.—On January 27th the new steel screw steamer *Nina*, which has been built by Messrs. William Dobson & Co., to the order of Messrs. Fenwick, Stobart & Co. (of which we gave particulars in our February issue, page 522), was taken to sea for her official trip, which resulted satisfactorily.

Val de Travers.—On January 29th the s.s. *Val de Travers*, built by Messrs. S. M'Knight & Co., Limited, of Ayr, to the order of Mr. John Harrison, of London, to meet the requirements of his rapidly increasing trade, proceeded down the Firth of Clyde to run her speed trials on the measured mile at Skelmorlie. The dimensions of the vessel are 200 ft. by 30 ft. 6 in. by 14 ft. She is constructed of steel to Lloyd's highest class under special survey, and is of the raised-quarterdeck type, with strong double bottom. Her deadweight-carrying capability is upwards of 1,050 tons, which is combined with a cubic capacity of about 50,000 cubic feet, whilst at the same time she has a net register tonnage of 275 tons. The machinery has been supplied by Messrs. Ross & Duncan, of Govan, and consists of a fine set of triple-expansion engines, having cylinders 17 in., 27½ in., and 44 in. diameter, by 33 in. stroke, supplied with steam by a large single-ended marine type return tube boiler working at 160 lbs. pressure. Steam-steering gear, windlass, and powerful steam winches for rapid handling of cargo have been fitted. The *Val de Travers* on trial had on board 1,043 tons of cargo, and was drawing 12 ft. 10 in. Six runs were made on the measured mile with and against the tide, and the mean speed obtained was 10·425 knots, which was considered highly satisfactory, especially as the speed attained against wind and tide was 10·23 knots.

Trent.—On February 1st the new steamship *Trent*, built by Messrs. R. Napier & Sons, Limited for the Royal Mail Steam Packet Co., London (of which we gave particulars in our October issue, page 331), completed her official trials on the Firth of Clyde. The machinery consists of a set of triple-expansion engines, having cylinders 37 in., 58 in., and 97 in. diameter by 5 ft. 6 in. stroke, and six single-ended boilers for a working pressure of 180 lbs. The machinery is capable of indicating about 8,000 H.P. The Royal Mail Co. were represented by Mr. Arthur, their superintending engineer, and the results of the two days' trials were very satisfactory, the speed having been easily attained, and the other conditions of the contract fully complied with.

Nubia.—On February 3rd the fine large screw steamer *Nubia*, built by Messrs. William Gray & Co., Limited, and owned by the Hamburg-America Line, Hamburg, was taken to sea for her trial trip. The vessel has been built to Lloyd's highest class, her principal dimensions being:—Length between perpendiculars, 338 ft.; breadth, 51 ft.; depth, 26 ft. 11 in. The engines have been supplied by the Central Marine Engine Works of William Gray & Co., and have cylinders 25½ in., 40½ in., and 67 in. diameter by 45 in. stroke. The boilers are three in number, single-ended, 13 ft. 3 in. diameter by 10 ft. 6 in., and work at a pressure of 170 lbs. per square inch. A speed of ten knots was averaged against a rough sea, the vessel being in ballast trim.

Steam-launch.—On February 7th Messrs. Matthew Paul & Co., Dumbarton, tried for speed at the mouth of the Leven a handsomely constructed steam-launch, fitted with engines having their patent single eccentric valve gear, which has since been shipped to her owners abroad. The trials, which were in every respect satisfactory, the speed attained being close on eight knots, were watched on behalf of the owners by their consulting naval architect, Mr. David Pollock, M.I.N.A., 128, Hope Street, Glasgow.

Telefon.—On February 8th the fine screw steamer *Telefon*, built by Messrs. Wood, Skinner & Co., Limited, Bill Quay, Newcastle-on-Tyne, for Mr. P. A. Gron, of Sandefjord, Norway (of which we gave particulars in our February issue, page 522), left the Tyne for her official trial trip. A large company on board, included Mr. Gron, jun., representing the owner; Mr. Skinner, sen., Mr. Skinner, jun., and Mr. J. Wood, jun., representing the builders; Mr. D. Myles, representing the engineers, Mr. Larsen, of Det Norske Veritas, and Mr. Klaveness, of Sandefjord. The vessel attained a mean speed of 10 knots, which was considered very satisfactory, and afterwards left for Pensacola, under the command of Captain A. D. Christensen, of Skien, Norway.

H.M.S. Assurance.—On February 9th H.M.S. *Assurance*, built by Messrs. J. M'Arthur & Co., Paisley (of which we gave particulars in our January issue, page 479), went down the river on her trial trip. The trials were in every respect satisfactory, the speed and power required being easily exceeded. The Admiralty were represented at the trial by Messrs. Rawlins, Smith, Jago, and Bolden. On completion of her trials the *Assurance* sailed for Devonport.

Lochwood.—On February 13th the steel screw steamer *Lochwood*, built by Messrs. Craig, Taylor & Co., Thornaby-on-Tees (of which we gave particulars in our February issue, page 522), proceeded to sea for her trial trip, which proved highly satisfactory. During the whole of the trip the engines worked with the greatest smoothness, and, on a run of 1½ hour, a speed of a little over 12 knots was maintained. The owners, Messrs. Constantine, Pickering & Co., Middlesbrough, were represented by Mr. William Constantine. The vessel proceeded to the Tyne to load for the Cape.

Sambia.—On February 13th, the fine steel screw cargo steamer *Sambia*, which has been built by the Flensburg Shipbuilding Company, Flensburg, to the order of the Hamburg-America Line, put out to sea for her official trial trip. Her principal dimensions are: 415 ft. by 50 ft. 2 in. by 30 ft. 3 in., moulded, having a deadweight capacity of about 7,500 tons. The vessel has been built to German-Lloyd's highest class A4 1, "three-deck rule," with long poop and forecastle. Accommodation is fitted amidships, the vessel having wood decks over all. She has been supplied with a large number of winches and derricks, and every other convenience for facilitating the quickest possible loading and discharging of cargoes. Triple-expansion engines have been fitted by the engineering department of this firm, having cylinders 26½ in., 44 in. and 72 in. by 48 in. stroke, steam being supplied by two large double-ended boilers. During the trial the vessel made a speed of 11¾ knots, the owners' representatives having expressed themselves highly satisfied both with the hull and machinery of the vessel.

Penmount.—On February 13th the fine steel screw steamer *Penmount*, built by Messrs. William Gray & Co., Limited, to the order of Mr. Richard B. Chellew, of Truro (of which we gave particulars in our February issue, page 523), was taken to sea for her trial trip. A very satisfactory trial run was made, after which the vessel proceeded to Cardiff to load for Buenos Ayres.

Shirley.—On February 13th this vessel had a very successful trial, doing 11 knots, light ship. The *Shirley* is a large steel screw steamer, built by Mess [illegible] for Messrs. Houlder, Midd [illegible] particulars in our [illegible] Hallett, Pattis [illegible] struction of this ship and her machinery on behalf of the owners, and their Mr. Ritson was present at the trial. This vessel proceeded to Cardiff to load.

Aqua.—On February 15th the new steamer *Aqua*, built by Messrs. Ropner & Son, of Stockton-on-Tees, to the order of Sir Christopher Furness, of West Hartlepool, for account of the Newman & Dale Steamship Co., Limited, of London (of which we gave particulars in our February issue, page 523), made her official trial trip in the Tees Bay. After the adjustment of compasses, she proceeded on her run to Cardiff, to load for Naples. The vessel has been built under the inspection of Mr. Maxwell Hill, of Newcastle-on-Tyne, and she will be commanded by Captain Thomas Tate. These gentlemen were present at the trial, and expressed entire satisfaction with the vessel. The builders were represented by Mr. Leonard Ropner.

Braeside.—On February 16th the s.s. *Braeside*, built by Messrs. R. Williamson & Son, Workington, for Messrs. Thomas Pinkney & Sons, of Sunderland, went down the Clyde on her trial trip. She is a vessel 128 ft. between perpendiculars, by 20 ft. breadth moulded, by 10 ft 4½ in., depth moulded, and carries 240 tons on 9 ft. 4½ in. loaded draught. She is built under special survey to Lloyd's 100 A1 class and steams 10 knots loaded. She is fitted with a set of McKie & Baxter's standard high ratio compound surface-condensing engines having cylinders 15 in. and 32 in. by 24 in., supplied by steam from a horizontal return tube boiler 10 ft. 6 in. by 10 ft. long. These engines are built upon the Standard design adopted by the firm three years ago and it is found that they are even more economical in coasting work than triple-expansion engines. The vessel's engines had not been tried until the morning she left Glasgow, and she proceeded to the Wemyss Bay mile when it was blowing a whole gale of wind. After the trials were over the vessel proceeded on her voyage, and the owner expressed himself highly pleased with the results attained.

Correspondence.

[In giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions expressed therein.—Ed. M.E.]

RECEIVER DROP IN MULTIPLE-EXPANSION ENGINES.

To the Editor of the Marine Engineer.

Dear Sir,—I have read with interest the paper on "Receiver drop in Multiple-Expansion Engines," published in your magazine for February, and read before the North-East Coast Institution of Engineers and Shipbuilders, by Professor R. L. Weighton, M.A., on the 19th ult. I do not propose to refer to the main object of the paper, which is most instructive, but to what is merely a side issue.

Can you tell me how the B.H.P., referred to in the tables, was obtained? The average B.H.P. was about 140, and to absorb this power by friction would entail serious difficulties; to measure it by driving a dynamo brings in the dynamo efficiency.

I am, yours truly,
A. C. F.

Dumbarton.

[I cannot do better than refer you to Vol. XIII. of the "Transactions of the North-East Coast Institution of Engineers and Shipbuilders," in which you will find a paper by Professor R. L. Weighton, M.A., fully describing the brake horse power appliances, and all other details of the engines at the college, Durham. You will find the power is absorbed by an hydraulic brake of special design.—Ed. M.E.]

Reviews.

Arc Lamps and How to Maintain Them. By H. Smithson and E. R. Sharpe. London: Whittaker & Co. 1899.

This little book is intended to give useful information, not so much to those who are engaged in the practical work of manufacturing or installing arc lamps as to those who have such lamps installed on their premises, and desire to understand their practical management and get the best results from them. Descriptions of the peculiarities of most arc lamps on the market are given, and amongst those discussed are the Brockie Pell, the Crompton, the Royce, and the Koerting and Mathieson amongst ordinary lamps, as well as those enclosed lamps which are founded on the Jandus patents. Reference is also made to the characteristics of alternating lamps and of inverted arcs. In the preliminary chapter the general points of an electric installation from the consumer's point of view are briefly discussed, and at the close a few hints on carbons are afforded. The book will certainly be useful to users of these lights, and it should not by any means be thought the less of in that it deals very tersely with its subject.

Electric Bells and Alarms. By F. E. Powell. London: Dawbarn & Ward.

The third number of the Model Engineer Series deals with a subject which appeals to every one who wishes to carry out those little jobs about the house which, if omitted, render the home uncomfortable, and which, if effected by the workman, often involve the householder in some expense and much uncomfortable delay. Most houses are now fitted with electric bells, and so the hints as to how to repair them will be generally useful, even if the fitting of them has already been effected by the builder. But there are other tempting forms of electric bells which may well occupy the ingenuity and labour of the amateur, and many valuable suggestions and hints in this regard will be found in Mr. Powell's little work. He tells how burglar alarms may be planned and carried out, and how common clocks, whether they be of the alarm construction or not in the first place, may be made into electrical alarms. These offer two advantages, in that they may be easily silenced when they have roused the sleeper, whereby much annoyance is often to be avoided; whilst, if the disturbance has only been temporary, they will again take up their necessary duty. The little task which the author has set himself seems to have been well achieved, and the results are likely to be useful to a large circle.

Lean's Royal Navy List, January, 1900. London: Witherby & Co.

The eighty-ninth issue of this standard work of reference is characterised by the fulness and accuracy of detail which have been so noticeable in its predecessors. The information it contains in regard to the biography of the members of the senior service is not only full, but of a kind which cannot be elsewhere found, whilst it is brought very fully down to date. The deaths of those officers who fell at Graspan and Ladysmith at the beginning of the military operations in Natal are all chronicled, together with the circumstances under which they fell and the service which they had previously seen. It is hard, indeed, to find any point in which improvement of such a work might be suggested; but, as this is pre-eminently a work of reference, the convenience of those who use it might be greatly facilitated if the printing on the edges were made to act as a guide to the contents of the various parts of the volume in the way which prevails with many directories and other such books.

Transactions of the Institution of Naval Architects for 1899. *Vol. XLI.* London. 1899.

An unusually important and valuable selection of papers is included in the present volume of these transactions. The first is from the pen of Sir John Durston, K.C.B., Engineer-in-Chief of the Navy. He gives an exhaustive account of a series of experiments conducted on board H.M.S. *Argonaut* in November and December, 1898, when the ship was tried by her contractors at 3,600, at 13,500, and at 18,000 I.H.P. The last-named speed, it should be noted, is her maximum. These trials are the first which have been made public with regard to the water consumption of engines in the Royal Navy, and they are therefore likely to be of very great instruction and value. From them it is seen not only what quantity of water is used by the main engines, but it is shown with great clearness that a very considerable proportion of the whole water evaporated, and thus of the coal burnt and of the power generated, goes to the auxiliary machinery. The problem of attacking the coal consumption of auxiliary machinery is one that must be dealt with in the near future. Economy here is not only needful, but likely to be attainable when full knowledge as to present conditions is reached. The first point is to diagnose the disease and learn its full extent; then we may learn how to apply remedies to it. Rear-Admiral Melville, Chief Engineer of the United States

Navy, read a valuable paper on "The Logical Position of the Motive Power of Warships." Whilst we in this country are adhering, after consideration, to the twin-screw principle for warships, the navy over whose engineering department Admiral Melville so ably presides has gone in for the triple-screw, and the present paper is at once a justification of the position thus taken up, together with a plea for the adoption of a triple-screw system where the middle propeller shall be driven by machinery whose power shall be equal to that of the two wing engines taken together. He gives three reasons in support of his proposition. At page 41 there is set out a summary of the arguments for and against the triple-screw, and this—as, indeed, the whole paper—can be studied with the greatest advantage. Mr. Milton's paper on "Steampipes" will be read with much interest by all those who remember the unaccountable failures which have of recent years taken place in this part of the marine engine—especially with that most recent example of failure, the steamship *Prodano*. Mr. Howden's paper on "Torpedo-boat Destroyers for Sea Service" elicited a somewhat warm discussion, but at the same time it ventilates a part of the question he discusses, which at the present time is not, perhaps, sufficiently regarded. Dr. Elgar's valuable paper on the "Distribution of Pressure on the Bottom of a Ship on the Blocks" in dry dock has, of course, especial reference to the unfortunate *Fulda's* case; but it may well have the attention of all those who are concerned in the construction and management of steamships with a long over-hang forward. Mr. Hunter's paper on "Large Atlantic Steamers," and Mr. H. F. Swan's discussion of the rise of the "Ice Breaker," both deal with important modern topics of marine architecture, whilst the papers on "Balancing" and on "Thrust Block Friction," by Herr von Kodolitsch, deal with necessary questions of marine engineering. The whole volume is got up in the usual handsome manner characteristic of these transactions, and is accompanied by a great wealth of valuable and instructive diagrams.

The Naval Word Book. By N. W. Thomas, M.A. Kiel: Lipsius & Tischer. 1899.

Mr. Thomas has afforded in a small volume a very useful collection of English and German words and expressions relating to nautical affairs. The equivalents are placed in parallel columns, and they arranged according to their relation, first to the ship and to her outfit, then to her manœuvring and docking, and so to her machinery department. Further on tactical phrases and the officer's career are dealt with. Facility of reference is sought as well by the general arrangement of the book as by a table of contents which is prefixed to it. The little work gives technical equivalents in a cheap and handy form, and will certainly be of great use to the seafarer who wishes to master professional German. It is not perhaps the first work of its class, but it is certainly the first we have seen which comes in popular form and at popular price. In an appendix will be found tables for the conversion of English to metric weights and measures. It is perhaps a pity that a cheap cloth cover has not been substituted for the paper wrapper, but that is a Continental characteristic.

Reed's Tide Tables and Nautical Almanac for 1900. Sunderland: Thomas Reed & Co.

We have received a copy of the fifty-seventh issue of this useful publication. Times of high water at the principal ports of the country, a general tide table for Great Britain, Ireland, and the west coasts of Europe, information as to the lighting, fog signalling, and buoying of our coasts, and as to the arrangements made for the electric communication with lightships are afforded as well as a good deal of purely local information. Amongst the latter is much that is useful to those who go thither with vessels. For example, there is a table showing the clear space under Sunderland Bridge at various states of the tide. ("Clear space," by the way, would be a more accurate description of what is meant than "height," for the actual height of the bridge is a constant.) Information as to local charges, local bodies of various kinds—the regulations which affect those who navigate the Wear—the collection of all these matters makes the book indispensable to others besides the residents of the port.

Electric Wiring, Fittings, Switches, and Lamps. By W. Perren Maycock, M.I.M.E London: Whittaker & Co. 1899.

Mr. Maycock's contribution to the Library of Arts, Sciences, and Industries is a very comprehensive and exhaustive one. It deals with the whole subject (which has now attained so great dimensions) of the application of electricity to lighting in domestic and public places. The practical work of the fitter is clearly explained. Full descriptions are given of the very manifold patent appliances for use and ornament which are now so commonly associated with electric light. The theoretical side of the question has also due attention. Diagrams and illustrations are afforded in great profusion, and the reviewer can only say that whilst the book has been in his hands it has proved of the greatest use to him in regard to an installation in which he is personally interested. The special case of ship-wiring has attention, and the latest devolopments—such of them as are of commercial interest at least—are all chronicled. The book is one which will prove useful to all students of the science as practically applied.

Marine Engines. By L. E. Bertin, Director of Naval Construction. Paris: Bernard & Cie.

Sir William White, in introducing to English readers the English version of M. Bertin's "Marine Boilers" (John Murray), recently translated by Mr. Leslie S. Robertson, writes as follows:—

"Although M. Bertin is so well known, not merely in France, but in all maritime countries, I may be permitted to indicate briefly what his claims are to deal with this important subject. He is one of the most eminent members of that distinguished body, the Génie Maritime. His career has embraced long service in the French dockyards, at sea, and in the Ministry of Marine . . . . As Chef du Service Technique at the Ministry of Marine . . . . he is responsible to the Minister of Marine for the practicability and technical accuracy of the designs for all new French ships. As a matter of fact, M. Bertin is the responsible designer of the latest and swiftest cruisers now building in France. Consequently no one is better placed for speaking authoritatively, and with complete information respecting the most recent French practice in marine engineering and boiler construction."

M. Bertin, from his official position as Chief Constructor to the French Navy, has the *entrée* to all the latest and most accurate data of ships built and building both in France and abroad, and he published a short while ago his extremely interesting book on "Marine Boilers," above referred to. It is therefore with no small interest that we awaited his companion volume on "Marine Engines" which has lately appeared. The ground covered by this book is more familiar to English readers than was the ground covered by his earlier volume on "Marine Boilers," which dealt more particularly with tubulous boilers, in which the French then had more experience than we had had, and therefore in one sense this present volume is hardly likely to prove so welcome an addition to technical literature on this side of the Channel as M. Bertin's first volume, which our contemporary, the *Engineer*, characterises as "the most noteworthy book on boilers that has been written."

We do not, however, wish to detract for one moment from the great value of the volume now before us: it is undoubtedly a masterpiece of careful compilation, handled with all M. Bertin's well known high scientific ability, and it should prove a work of reference of great utility to those to whom the French lauguage and the metrical system of weights and measures are not a hindrance. We can especially recommend it to the careful study of those who may be called on to lecture upon or teach marine engineering. This book, like his "Marine Boilers," is the outcome of M. Bertin's lectures to the students at the Ecole d'Application du Génie Maritime, which school prepares the future engineer officers for the French Navy, and therefore we may expect to find the subject matter treated in a highly scientific and mathematical manner. This is more especially the case in the first two chapters dealing with the properties and expansion of steam where the use of the calculus is freely employed.

Though in a short review like the present, it is impossible for us to attempt to do justice to a work of nearly 700 pages, let us now turn to the contents of the book itself, which we find divided into three distinct parts:—

I. The energy and distribution of steam in the cylinder.
II. The mechanical aspect of the steam engines.
III. The construction of steam engines.

The first three chapters are devoted to the mathematical treatment of the expansion of steam, energy contained in steam, and similar subjects, and is of a highly mathematical character, and, we fear, a good deal above the average practical engineer of this country. Some interesting details are given as to the great reduction that has been attained in the steam per I.H.P. per hour. In 1852 the *Napoleon* burnt 4·35 lbs. per I·H.P. per hour, whereas the *Forban* only burnt 0·90 lb. per I.H.P. per hour on her consumption trials. The relation of the weight and space occupied by machinery and boilers to the volume of the cylinders is discussed, and examples from actual practice are cited. Also the most economical power at which the engines can be run from the point of view of coal consumption is treated of, and M. Bertin points out that the most economical speed for the engines does not as a rule coincide with the speed of the engines that corresponds to the most economical speed of the ship, and he shows how these two speeds are related and that they must not be confounded.

The effect of compression on the power, economy, and safety of engines, or their immunity from accident, is fully treated, together with diagrams from actual practice, and the special relief valves used by M. Normand for this purpose are illustrated.

M. Bertin cites some interesting particulars from actual practice showing how the steam consumption of an engine may increase after she has been in commission for some time, and the causes giving rise to this. He draws attention to a matter which we fear is often neglected by some practical engineers, and that is the very pernicious influence that water has on the consumption and economy of steam, if the steam piping is not properly lagged, and condensation to any extent is allowed to take place in the pipes.

The subject of jackets is naturally one on which the opinion of engineers is largely divided, and M. Bertin cites cases from practice where their use has been both beneficial and also detrimental. He attributes the latter cases to want of proper draining, and this is only too often the case unless it is done automatically, as with the many calls on the attention of an engineer on watch, the draining of the jackets is naturally apt to escape his notice.

Chapter IV. occupies 73 pages and deals exclusively with valves, valve gears, valve diagrams, &c., and the subject is handled in a masterly way. Our space forbids us going into details, suffice it to say that the various well-known gears are all noticed, and their good and bad points discussed, as well as their influence on the steam distribution.

Part I. closes with Chapter V., on starting and turning engines, and the handling of the main engines. We don't know that there is much in this chapter of special interest, or that is not generally known in this country, and we shall therefore pass straight on to Part II.

Part II. opens with Chapter VI., on the turning moment and resistance to rotation, which are handled by M. Bertin very trigonometrically, and occupy about 20 pages. He passes on to the interesting questions of vibrations and forces tending to produce them. As would naturally be expected, he borrows freely from the excellent work done by Mr. Otto Schlick and Mr. Yarrow, and the discussion that has taken place in this country on this subject, adding some *data* obtained from observations on vessels of the French Navy.

Chapter VII. deals with the lubrication and internal friction of engines. The methods adopted abroad for lubricating the various moving parts of the engines are illustrated, but do not seem to differ materially from the similar arrangements usually adopted in this country. What M. Bertin calls "the coefficient of wear" is defined and illustrated by a long table containing particulars of the leading vessels in the French Navy.

M. Bertin consecrates nearly ninety pages, forming Chapter VIII., to the important subject of Propellers. The chapter contains a mass of information of a practical nature, drawn from the best practice of the day. No less than seven tables are given covering the ground from the early wooden ships to the latest fast destroyers. The work on this subject done by M. Normand in France, Messrs. Froude, Thornycroft, Barnaby and others in this country is analysed, and the results given in a handy form. Multiple screws on one shaft seem to have been used as early as 1850 by Mr. Doyère, but the screws were too close and the result unsatisfactory. M. Terré, one of M. Bertin's chief assistants, is using them again now on the *Grenadier*, similarly to Mr. Parsons on the *Turbinia*.

Chapter IX. occupies about eighty pages and is given up to the description of condensers, air pumps, circulating pumps, and kindred subjects. M. Bertin shows how the present tendency is to use separate condensers and air pumps in the best recent practice, what has led to their adoption, and the advantages and disadvantages of their use. He discusses the efficiency of the cooling surface and the amount required in relation to the H.P. and the H.S. and valuable tables giving the particulars and dimensions of a large number of boats are given. This chapter closes Part II.

Part III. contains three chapters. Chapter X. on the strength of materials, Chapter XI. on the principal moving parts and the framing of an engine, and Chapter XII. on the general arrangements of engines on board and the weight and space occupied.

Chapter X. is interesting as containing the allowances and stresses permitted abroad in the various moving parts, as compared with the usual practice on this side of the Channel, but space prohibits us dealing exhaustively with the subject matter of this chapter. We note that Mr. Seaton's valuable work on the steam engine is largely referred to throughout the present volume whenever they cover the same ground.

Chapter XI. deals with such details as cylinder linings, glands, stuffing boxes, pistons (conical and otherwise), piston rods, slippers, guides, and so forth, all of which are fully illustrated as the various parts are discussed.

Chapter XII., the closing chapter of the book, gives what, to many designers and chief draughtsmen or those occupied in getting out designs, will prove of the greatest value, and that is the actual finished weights of all classes of vessels from the smallest to the largest. As these weights are drawn from official sources not open to the general public, they should prove of exceptional value, and, taken together with the similar tables for boilers published in M. Bertin's "Marine Boilers" are in themselves quite unique.

We are sorry to see that M. Bertin has not included an Index, and this is a distinct want in a work of reference of this nature. The volume is full of the most valuable information from beginning to end, but the trouble will be to know where to find it when it is wanted, without an index.

There are nearly 400 illustrations scattered over a volume of 700 pages.

The work will be a distinct addition to our technical literature. The amount of information contained in it is enormous. The subject matter is handled in a masterly way by a man of exceptional ability and unrivalled opportunities of access to the very best and latest information all over the world, and we can confidently recommend it to those of our readers who are familiar with the French language.

(It may be of service to some of our readers to point out that M. Bertin's book on Marine Boilers, above referred to, is published in English by Mr. John Murray.)

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships from December 7th, 1899, to February 2nd, 1900.

23856	A. Dalrymple. Ship's propeller shaft bearing.
23873	D. de la M. du Boulay. Steering ships.
23881	A. M. Rust. Controlling marine engines.
23882	F. Nockold. Increasing stability of ships.
23884	H. C. Bull and J. Ramage. Steam generators.
23889	J. Lewthwaite and A. E. Williams. Reducing friction in bearings.
23895	J. P. Jensen. (The Union Boiler-Tube Cleaner Co., United States.) Operating boiler-tube cleaners.
23898	H. J. Lawson. Engines.
23903	H. Buderas. Supplying furnaces with fuel.
23910	J. and J. R. Temperley. Shaft bearings.
23924	S. Lake. Submarine vessels.
23927	J. R. E. Warren. Lubricant composition.
23935	T. Christie. Berths for use on board ship.
23939	G. Bulman. Rowlocks for boats.
23961	T. O. Newman. Dredging apparatus.
24022	S. Couper. Condenser.
24023	P. Kestner. Steam generators.
24030	J. Hamilton. Davits.
24036	S. H. and W. H. Baker. Furnace fire-bridge.
24038	V. Arschasuloff. Watertight sliding doors.
24047	A. J. Boult. (E. R. Krocker, Austria.) Vessels, &c.
24068	G. M. Robertson. Governor for turbines.
24076	J. F. Simpson. Expansion joints for pipes.

24077 J. F. Simpson. Metallic packing for piston rods.
24080 R. A. Sloan. (W. H. Martin, Holland.) Direct-acting pumps.
24088 A. MacLaine. Packing for steam pistons.
24113 D. G. Martens. Means for saving life at sea.
24142 J. Y. Johnson. (N. A. Guillaume, France.) Engines.
24159 F. and F. Rough. Friction gearing.
24193 E. McConville. Steam boilers.
24204 C. Griffin. Rotary steam engines.
24218 H. H. Lake. (A. Freeman, United States.) Steam boiler furnaces.
24219 C. H. Whitaker and A. C. Whiting. Steam traps.
24256 H. Hutchinson. Anchors.
24322 J. and J. R. Temperley. Steam hoisting engines.
24333 W. Jones. Life belt.
24343 T. W. N. Kendall. Apparatus for propelling boats.
24348 A. F. Evans. System of valves for engines.
24349 A. F. Evans. Exhaust silencers for engines.
24350 A. F. Evans. Speed governors for engines.
24351 A. F. Evans. Lubrication of engines.
24367 G. F. G. Des Vignes and W. A. Cloud. Steam generators.
24386 J. H. K. McKollum. Steam engines.
24415 G. G. and M. S. Forbes. Water gauges.
24443 H. W. Fairbrass and F. Cundall. Rowlocks.
24446 C. Burnett. Charging steel melting furnaces.
24471 A. B. Kokernot. Propellers for vessels.
24492 E. D. Morgan. Control valves for hydraulic machinery.
24520 G. H. Biddles. Indicator for steam generators.
24562 C. D. Moberg. Water-tube steam boilers.
24575 C. Bliault. Device for saving life at sea.
24577 J. McLachlan. Packing cylinders.
24592 J. Proctor. Furnaces for steam boilers.
24611 J. Sauer and E. M. Goldbeck. Buffers for ships.
24672 W. Fairweather. (The Babcock & Wilcox Company, United States.) Steam generators.
24699 W. D. Allen. Making metallic castings.
24707 A. J. Boult. (C. M. A. Maginot, France.) Pumps.
24751 R. A. Hadfield. Appliances for casting steel.
24768 A. Austin and E. Dry. Propelling steamboats.
24771 M. Paul. Lubricating shafts of engines.
24820 D. G. Martens. Propellers for ships.
24821 D. G. Martens. Propeller blades.
24836 J. Haythorn and the Haythorn Tubulous Boiler Syndicate, Limited. Steam boilers.
24873 S. C. Davidson. Centrifugal fans.
24889 D. Whittle. Propelling pleasure boats.
24912 J. Holt. Propellers.
24918 A. Waller. Compasses.
24967 J. Gottlob. Preventing incrustation in boilers.
25001 C. F. Thompson. Reversing engine.
25038 R. B. Christie. Screw propeller shafts.
25045 W. C. Lockwood. Spanners and wrenches.
25046 A. Burzloff and F. E. P. Müller. Lubricating apparatus.
25059 T. H. Wells. Water-tube boilers.
25065 J. H. Stone, P. H. Bailey, H. Stone, and C. N. Milner. Vacuum hand pumps.
25068 E. Gessner. Feeding apparatus for engines.
25093 T. H. H. Bodde. Preventing collisions at sea.
25096 N. C. Vaughan. Armour.
25115 T. and J. Vicars. Mechanical stokers.
25116 G. K. B. Elphinstone and A. C. Heap. Speed indicator.
25141 H. L. Perrine. Duplex pumping engines.
25142 H. L. Perrine. Direct-acting pumping engines.
25198 W. May. Fog signalling at sea.
25208 B. H. Thwaite. Armour pads.
25229 J. J., T. F., and J. W. Meldrum. Supplying air to furnaces.
25230 G. W. Sutton. Hydraulic dredgers.
25239 S. Baldwin. Screening ashes from furnaces.
25240 O. Oldham and W. N. Dack. Separating water from steam.
25244 J. C. Dobbie. Steam engine indicators.
25247 H. Smith, H. Smith, jun., and O. Smith, Machines for bending steel.
25286 G. A. Lindström. Distributing oil upon water.
25300 C. Ransom. Crank shaft.
25302 P. Franz and H. Sauer. Steam valves.
25303 A. Barthelmebs. Pumps.
25309 C. A. Jackson. Manipulating cranes.
25310 P. Fyfe and A. Phillips. Lights for ships.
25315 H. F. Talbot. (H. Pearse and E. F. Tevers, Argentine Republic.) Compound rotary engines.
25317 G. E. A. Holdsworth. Composition for ships' bottoms.
25351 A. Piedfort. Steering gear for vessels.
25427 T. Rumler. Removal of scale in steam boilers.
25433 F. W. Golby. (J. Schütte, Germany.) Steam boilers.
25437 S. C. Davidson. Speed reducing gear.
25440 J. Stumpf. Valve gear.
25441 J. Stumpf. Valve gears.
25518 M. L. V. E. Vaisse. Valves.
25520 F. W. Barthells. Forming flanges on tubes.
25527 W. E. Heys. (J. McDonald, Japan.) Balanced slide valves.
25529 J. A. Holden. Ships' berths.
25542 W. A. Ashworth. Governing steam engines.
25561 E. S. Dixon. Tube stopper.
25572 C. M. Johnson. Wave and tide motors.
25577 J. G. Lorrain. (L. W. Myers, United States, Lifeboats.
25579 A. A. Freemann and O. Armstrong. Lubricators.
25580 A. A. Freeman and O. Armstrong. Sight feed lubricators.
25584 W. Bandisch. Protecting river embankments.
25593 R. Haddan. (The firm of Lantai & Havas, Hungary.) Cleaning boiler tubes.
25604 E. Ingraham. Boilers.
25612 J. Cleland and J. C. Stewart. Steam trap.
25632 A. Taggart. Flues for steam generators.
25667 G. Harris. "Otter" or trawl boards.
25668 O. J. Allen. Steam vessel.
25680 P. F. Oddie. Pumps.
25684 W. Hartmann. Lubricating bearings.
25709 F. H. Royce. Electrically driven cranes.
25712 J. C. Dobbie. Navigational sounding apparatus.
25724 W. Grail. Lifebelts.
25725 F. Knoeferl. Steam pressure gauges.
25733 O. Ritcher. Steam valves.
25775 J. Chorlton and J. A. Holden. Ships' berths.
8 J. Klein. Condensers for steam engines.
42 J. A. Belk. Raising vessels.
66 W. D. Williams and J. H. Stephens. Rotary reciprocating engines.
104 C. and A. C. Reeves. Compound steam engines.
118 J. C. Fell. (T. G. Hall and D. L. Harris, United States.) Marine buoy safes.
124 L. C. Lanphear. Feed-water heaters.
125 T. J. Whitney. Feed-water heaters for boilers.
126 J. W. Gardner. Speed and pressure governors.
132 A. J. C. Martini. Marine equipment sacs.
139 R. Schulz. Plates for water-tube boilers.
146 J. H. McGurty and T. McEwan, jun. Speed governor.
161 R. H. Alexander, jun. Watertight doors for ships.
190 J. Duthie. Ship shell riveting.
199 W. P. Thompson. (J. G. Kayser, Germany.) Lubricating bearings.
200 W. P. Thompson. (J. G. Kayser, Germany.) Shafting supports.
222 J. Lewthwaite. Oil engines.
230 T. Bradley. Pontoons.
236 W. G. Armstrong, Whitworth & Co., Limited, and E. L. Orde. Supplying liquid fuel to burners.
360 J. Morrison. Reboundable armour plate.
377 E. Edwards. Saving vessels at sea.
413 H. Simpson. Arresting the motion of vessels.
419 W. E. Pott. Water level indicators.
446 E. Jones. Combination tool for use of engineers.
450 J. E. L. Ogden. Steam-pressure pumps.
476 E. Gobbe. Means of heating of steam boilers.
513 W. S. Elliott. Tube cleaners.
537 J. J. Kaye. Stopping engines.
587 H. Butters. Slide valves for steam engines.
610 C. F. Cronheimer. Telegraph for use on ships.
621 J. F. Duke. Propulsion of vessels.
633 L. Bayer. Cylinders with liquid packing.
639 J. W. White. Conveyors for transporting coal.
658 H. A. C. Parker. Single acting motive-power engines.
660 W. Glass. Reversing gear for launch engines.
699 G. G. M. Hardingham—(F. H. Trevithick, Egypt.) Utilising steam.
714 S. F. Wiles. Internal combustion engines.

742 G. Catanzano. Ships' propellers.
771 W. Kneen. Boiler furnaces.
779 R. H. Smith. Steam engine indicators.
789 G. Chapman. Ship propulsion.
799 W. H. Wilson. Construction of steam engines.
803 E. D. C. de Yarmett and E. M. Haynes. Water-tube boilers.
809 G. Wilks. Adjustable bearings.
820 C. F. Huppenbauer. Utilising water under high pressure.
836 A. E. Jones. Steering torpedoes.
879 R. T. Surridge. Cylinders for steam engines.
880 J. Heim. Course indicator for ships.
883 J. P. Bayly. (C. de Redon, France.) Boats.
897 H. W. Branch. Apparatus for cleaning ships.
898 W. Schulz. Automatically feeding boilers.
904 E. Estrella. Lifeboats.
948 J. & L. A. R. Lichetti. Ship's propeller.
966 W. A. Koneman. Rotary engines.
976 M. Shearer. Steam pressure indicators for boilers.
988 P. A. Newton. (J. Mujabara, Japan.) Water-tube boilers.
1003 G. H. Perkins. Sailing vessels.
1005 A. Reynolds. Furnaces for heating long forgings.
1050 E. A. Levins and C. Nelson. Paddle-wheels.
1070 E. Hafner. Gauge cocks for steam boilers.
1076 A. J. Wilton. Valve motion of pumps.
1105 W. C. Borrowman. Steam traps.
1111 E. H. Hudson and J. Rann. Controlling draught in flues.
1117 A. N. Chamberlain and W. L. B. Hall. Ships' berths.
1124 D. B. Cumming. Feed-water heater.
1140 J. Oman. Discharging cargo from vessels.
1153 E. Beabby. Ovens for use on shipboard.
1158 A. H. Williams and H. Bates. Combined deck seat and life raft.
1188 R. Roger. Brakes for steam trawl winches.
1206 M. de Pokrzywnicki. Superheating steam.
1209 R. H. Taylor. Safety valves.
1246 W. Campbell. Blocks for working ships' boats.
1249 G. West. Steam valves.
1257 A. N. Wilson. Slide valves.
1291 P. Jensen. (O. Falsen, Norway.) Warning signals on ships.
1303 J. Stumpf. Preventing condensation losses in engine cylinders.
1308 C. E. Livesay. Controlling water flowing from rivers.
1316 J. Brown, H. Pennington, and W. Schuer. Feed valve.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.

January 27th, 1900 Naservanji, Navroji Ex 1C N. Shields

Note.—1C denotes First Class; 2C Second Class.

January 6th, 1900.
(*Continued.*)

Rode, Geo. L. .. 1C Glasgow
Smallwood, R. 1C Liverpool
Spencer, Chas. 2C Cardiff
Stevens, A. .... 1C Glasgow
Thompson, J... 2C Cardiff
Thomson, Alex. 1C Liverpool
Walker, Alex... 2C Glasgow
Weir, Peter .. 2C ,,
Williams, D. G. 1C Cardiff
Wilson, W. S... 1C Glasgow

January 13th.

Cairns, John .. 2C Dublin
Clark, Thos. W. 1C London
Cribbes, Thos.. 1C Leith
Fisher, Peter .. 2C Greenock
Harrison, A. E. 2C Hull
Moore, Samuel 2C Dublin
Osborne, Thos. 1C ,,
Redman, W. .. 1C Hull
Ross, James .. 1C Leith
Russell, James 1C Liverpool
Smith, Henry.. 1C Hull
Sowerby, N. H. 2C Greenock
Stirling, John.. 1C London
Thorpe, C. H... 2C ,,

January 20th.

Allan, George F. 1C W. Hart'l
Baillie, David .. 2C Glasgow
Barclay, John.. 2C Liverpool
Bence, William 2C London
Carnegie, John.. 2C Glasgow
Cornforth, C. .. 2C W.Hart'l
Davies, Walter.. 1C ,,
Deare, J. J. W. 1C London
Dickie, D. M. .. 1C Glasgow
Duncan, J. B... 1C ,,
Fishwick, Henry 1C Liverpool
Fleming, F. J... 2C Dundee
Forrest, Thomas 2C Glasgow
Gordon, Alex. .. 1C ,,
Kanalis, Nicholas 2C W.Hart'l
Kirk, William .. 1C ,,
Lawton, John .. 1C Liverpool
MacKenzie, J.H. 1C Glasgow
Mason, James .. 1C W.Hart'l
Miers, H. S..... 2C ,,
Mountain, J. D. 1C N.Shields
Nino, Leopold . 1C ,,
Niven, John H. 2C Glasgow
Pappademetropoulos, D..... 2C London
Phillips, Tom R. 1C Cardiff
Pollock, John .. 2C Glasgow
Pyves, Walter .. 2C Cardiff
Robertson, T. O. 1C Glasgow
Shone, James .. 1C London
Stiles, H. C..... 2C Glasgow
Varrelmann, F. W. ... 1C London
Watson, George 2C N.Shields
Woods, F. H. .. 2C London
Wootton, W. A. 2C W.Hart'l
Wraight, J. F... 1C Liverpool
Wright, John B. 1C N.Shields
Young, John .. 1C Glasgow

January 27th.

Adams, Peter G. 2C Liverpool
Alderson, George 2C N.Shields
Burtt, John F. 2C ,,
Chapman, W. C. 1C Sun'land
Cox, Thomas .. 2C N.Shields
Dickenson, T. 2C ,,
Donald, George 1C Aberdeen
Edmonds, Wm. 2C London
Fawcett, J. L. 2C Hull
Fletcher, T. B. 1C Sun'land
Fraser, Wm. J. 2C London
Hedley, Wm. S. 2C N.Shields
Irvine, George 1C Aberdeen
Jones, John E. 2C Liverpool
Laing, Alfred J. 1C Sun'land
Marshall, C. W. 1C N.Shields
M'Donald, Wm. 1C London
M'Lintock, Wm. 1C Sun'land
Moore, Wm. D. 2C ,,
Patterson, Ed. 1C Aberdeen
Scott, Wm. B. 2C ,,
Simpson, Harry 2C Liverpool
Slater, A. D. 2C London
Stephen, Wm. 1C Aberdeen
Tait, Geo. Wm. 2C London
Whyte, Geo. L. 1C Liverpool
Wright, Frank 1C ,,

February 3rd.

Aitken, David H. 2C Glasgow
Allen, Chas. T. 1C London
Anderson, A. E. 2C ,,
Anderson, Alex. 2C Glasgow
Bellhouse, Chas. 1C Liverpool
Berryman, Geo. 1C Falmo'th
Boyd, Walter .. 2C Glasgow
Brewer, R.W.A. 2C N.Shields
Brown, J. R. G. 1C Liverpool
Burt, J. W. E. 2C Cardiff
Crump, Hubert 2C ,,
Davies, Morris 2C Liverpool
Evans, William 1C Cardiff
Fielding, M. .. 2C ,,
Forster, Alex. R. 1C N.Shields
Freeborough J.S 2C Liverpool
Groves, A. T. .. 1C N.Shields
Hendry, H. S. 1C Glasgow
Holdsworth, W. 2C London
Horsburgh, H. 2C ,,
Hunting, P. R. 1C N.Shields
Hutchison, W.W 1C ,,
Inglis, Peter .. 2C Glasgow
Isherwood, W.F. 2C Cardiff
Kelly, John T. 2C Liverpool
Lennox, Alex... 1C Glasgow
Middleton, D. M. 1C London
Milburn, Geo. R. 1C N.Shields
Millen, William 2C Glasgow
Mills, Thos. A. 2C Cardiff
M'Kinlay, D. .. 1C Glasgow
Moss, John A. 1C Liverpool
M'Pherson, C... 2C Glasgow
Nelson, Alek... 2C ,,
Nicholson, T. C. 1C N.Shields
Nicol, E. W. L. 2C Glasgow
Purvis, John E. 1C N.Shields
Saunders, H. W. 2C S'thmptn
Sedcole, James 2C N.Shields
Slater, Robert 1C ,,
Smith, E. A. O. 2C Liverpool
Sprunt, F. W... 1C S'thmptn
Thomson, Robt. 1C Glasgow
Wachter, Alex. 1C S'thmptn
White, Andrew 1C Glasgow

February 10th.

Booth, Jesse .. 2C N.Shields
Brown, J. W. G. 1C Liverpool
Carter, A. A. B. 2C London
Dowsen, J. W. 2C N.Shields
Fleming, F. A. 1C London
Fletcher, Alexr. 2C Liverpoo
Forbes, J. J. A. 1C N.Shields
Hunter, John J. 1C ,,
Lloyd, Wm. E. 2C ,,
Longstaffe, A. H. 2C Liverpool
Matthewson, A. 2C N.Shields
Morris, Alexr. 2C ,,
Nelson, Harry 1C London
Ratsey, V. B... 1C ,,
Reid, Thomson 1C N.Shields
Scott, H. A. .. 2C London
Shepler, C. H. 2C N.Shields
Smith, C. S. .. 1C Liverpool
Walsh, Wm. D. 2C ,,

February 17th.

Anderson, Peter 1C Leith
Bain, Donald.. 1C ,,
Brock, James C. 1C N.Shields
Bryan, James.. 2C Liverpool
Bryce, John C. 2C ,,
Burns, Matthew 1C Dublin
Chambers, J. F. V. ... 2C Liverpool
Christodulakis C 2C London
Church, H. A... 2C ,,
Clarke, Peter W. 2C ,,
Cormack, C. R. 2C Leith
Cromb, Alexr... 2C ,,
Davis, F. S .. 2C London
Deighton, Thos. 1C Liverpool
Dowling, R. J. 2C Greenock
Goold, John .. 2C ,,
Hedgcock, Jas. 1C Hull
Hunter, John .. 1C Greenock
Jary, Chas. H. 2C N.Shields
Jennis, W.J.E. 1C London
Lamb, Wm. J. 2C Liverpool
Macnaught, S. 1C London
Martin, Thomas 2C Greenock
M'Inroy, John 2C Leith
M'Kinnon, W.M. 2C Greenock
Morrell, Geo. E. 2C London
Munro, John R. 1C Greenock
Peel, William .. 2C N.Shields
Pick, Wm. E... 2C Hull
Pollock, Thos. 1C Greenock
Rankin, Robert 2C ,,
Rawson, Chas. 1C ,,
Rickards, E. E. 2C Leith
Ritchie, Duncan 1C Liverpool
Rutherford, J. 2C ,,
Shiels, Daniel.. 2C Leith
Shimmons, W. J. 1C Dublin
Stevenson, A. C. 2C Leith
Thompson J. T. 2C N.Shields
Townsend, H. 1C ,,
Tucker, Wm. T. 1C ,,
Walls, Wm. J. 1C Liverpool
Whitefield, Jas. 2C N.Shields
Winship, C. E. 2C ,,
Youngson, Peter 1C ,,

[REGISTERED FOR TRANSMISSION ABROAD
Vol. XXI. No. 241. APRIL 1, 1899. PRICE 6d., by Post, 8d.

THE MARINE ENGINEER:

A MONTHLY JOURNAL OF MARINE ENGINEERING, SHIPBUILDING & STEAM NAVIGATION.

OFFICES: 3, AMEN CORNER, PATERNOSTER ROW, LONDON, E.C.

Efficiency superior to any hitherto brought out.
THORNYCROFT PROPELLERS
Designers and Makers:
J.I. Thornycroft & Co., Chiswick, London.

PHOSPHOR BRONZE
(Cog Wheel and Vulcan Brands).
ANTIFRICTION ALLOYS.
(*See Advt. back of Cover*).

ROSS & DUNCAN,
Marine Engineers and Boiler Makers
WHITEFIELD WORKS, GLASGOW.
BREMME'S PATENT VALVE GEAR,
DUNCAN'S PATENT PROPELLER.
Contractors for Steam Vessels of all Kinds.
ON ADMIRALTY LIST.

JOHN WILKES, SONS & MAPPLEBECK, LTD.
BIRMINGHAM.
MANUFACTURERS OF
BRASS AND COPPER TUBES
For Locomotive and Marine Boilers, Condensers, &c.
METALS, WIRE, &c.

TUCKS "TRIPLE" METALLIC PACKING.
See Advertisements
PAGES xii. & xix.

TO INVENTORS & PATENTEES
DON'T BUY, SELL, OR TAKE OUT
PATENTS
BEFORE APPLYING TO
THE INVENTORS' MEDIUM, LTD.
Chief Office—76, CHANCERY LANE, LONDON, W.C.
Branch " 78, HIGH HOLBORN, " "
All information free of charge. Established 1830.

New Edition. Now Ready 12/6.
Contains complete sets of new Questions just issued.
BERGEN'S
MARINE ENGINEER
AND GUIDE BOOK TO THE BOARD OF TRADE EXAMINATION.
Text profusely illustrated. 50 large new and valuable Plates to illustrate Parts of Engines.
W. J. POTTS, NORTH SHIELDS.

HOLZAPFEL'S COMPOSITIONS COMPANY Ltd.,
International Antifouling Composition, &c. See page v.

MAGNOLIA ANTI-FRICTION METAL
Has been proved by Experts to Show from 35 to 53 per cent. LESS FRICTION than its Competitors.
None Genuine except with our Trade Mark stamped on each Ingot and Box.
MAGNOLIA Anti Friction METAL Co., of Gt. Btn., Ld.,
49, Queen Victoria St., London, E.C.
Telegraphic Address: "*Magnolier, London.*"
17, St. Ann's Sqr., Manchester; 93, Hope Street, Glasgow, Maritime Buildings, Newcastle-on-Tyne, &c., &c.

TO INVENTORS.
E. P. ALEXANDER & SON,
(*Fel. Chartered Inst. Patent Agents*),
19, Southampton Buildings, Chancery Lane, W.C.
All business relating to British and Foreign Patents, Designs and Trade Marks transacted on moderate Terms. Pamphlet and General Advice Gratis.
Telegrams, "EPA, LONDON."
ESTABLISHED 18 YEARS.

STRONGEST MALLEABLE BRONZE
DELTA METAL
PROPELLERS AND PROPELLER BLADES, PUMP RODS, STUDS, BOLTS & NUTS, PLATES, TUBES, WIRE, RODS of any SECTION.
Large Stocks at LONDON, LIVERPOOL, and GLASGOW.
THE DELTA METAL CO., LD.,
110, CANNON STREET, LONDON, E.C.
Contractors to the Admiralty, War Office, India Office, and various Foreign Governments.

IRON TUBES STEEL
LLOYD & LLOYD, LTD.,
BIRMINGHAM

PATENTS.
DESIGNS. TRADE MARKS.
WHITE & WOODINGTON,
Rooms: 221–225, Birkbeck Bank Chambers, Southampton Buildings, London.
30 *Years' Experience. Highest References.*
MARINE SUBJECTS A SPECIALITY.

"BITUMASTIC." See Page xxxv.

CRANE'S OILS
FOR MARINE USE.
CYLINDER & ENGINE OILS.
29, Fenchurch Street, London

THE CITY PATENT AGENCY FOR MARINE PATENTS.
J. C. FELL, Fel.Chr.Inst.P.A., Wh.Sc.M.I.M.E.,
R. W. JAMES, Fel.Chr.Inst.P.A., A.M.I.C.E., M.I.M.E.
(Late Fell & Wilding).
Patents, Trade Marks, and Designs in all countries. Best Technical, Scientific and Legal Advice. Searches made. Address any enquiries to FELL & JAMES, 1, Queen Victoria Street, London, E.C.

P. JENSEN, Chartered Patent Agent, M. Inst. M.E. Twenty-nine years' experience in securing British, Colonial, and Foreign PATENTS, Trade Marks, and Designs. Full particulars on application.—Office for JENSEN & SON, 77, Chancery Lane, London.

THE BROUGHTON COPPER CO. LTD.
MANCHESTER.
Copper Smelters and Manufacturers of
COPPER, BRASS & BRONZE TUBES
For Marine, Locomotive, and other Purposes.
INGOTS, RODS, SHEETS, PLATES, &c.
ELECTRO-COPPERING ALLOYS.

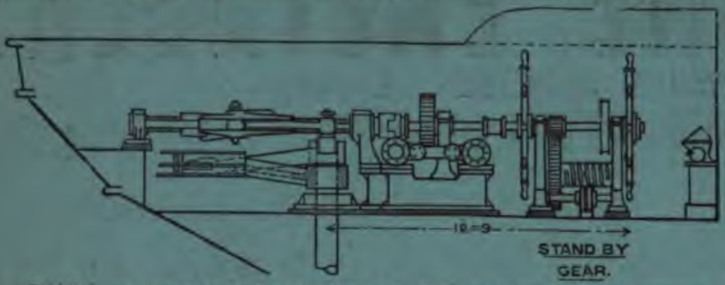
TUBES! IRON & STEEL BOILER TUBES.
OF SUPERIOR QUALITY.
JAMES EADIE & SONS,
CLYDESDALE TUBE WORKS,
RUTHERGLEN, near GLASGOW.
Prices and Discounts on application.

NEW EDITION THE 16TH
Containing NEW QUESTIONS just issued and Papers
REED'S
ENGINEERS
HAND-BOOK
TO THE
BOARD OF TRADE EXAMINATIONS.
Illustrated by 344 Diagrams, and 36 Plates of parts of Engines. 14s. post free.
THE KEY to the same, price 7s. 6d., post free.
SUNDERLAND: THOMAS REED & Co.,
184, HIGH STREET WEST.
See page x for particulars.

For Index to Contents, see page xvii. For Index to Advertisements, see page xv.

THE HARRISON ENGINE Co., LTD.

Direct Acting Steam and Hand Steering Gear, with HARRISON'S PATENT RUDDER CONNECTIONS.



CHAINS not used except as "Standby." The continual danger, trouble and expense of chain repairs is done away with, when working through right and left hand screw gear for hand and steam steering.

CROSS LANE, MANCHESTER.

MAKERS OF A LARGE VARIETY OF
STEAM & HAND STEERING ENGINES
SUITABLE FOR ALL TYPES OF VESSELS.

Telephone: NAT 1734.
Telegraphic Address: STEERING, MANCHESTER.

London Office:
J. D. CHURCHILL, 9, London St., E.C.
Glasgow Agent:
W. G. MORRISON & CO., 59, St. Vincent St.
Liverpool Representative:
JOHN HARRISON, Blundelsands.

THE BEST METALLIC PACKING IN THE WORLD.

THE BEST IN DESIGN, IN CONSTRUCTION, IN RESULTS.

OVER 105,000 SUPPLIED.

FOR MARINE ENGINES OF ALL SPEEDS AND PRESSURES.

Supplied to the **BRITISH, UNITED STATES, SPANISH, DUTCH, &c., NAVIES.**

The United States Metallic Packing Co., Ltd., Bradford, England.

REGISTERED NOMOS TRADE MARK.

"NOMOS"

Anti-Corrosive & Anti-Fouling Compositions.

FOR COATING SHIPS' BOTTOMS.

Agents and Stocks at all Principal Ports.

Also "**FAROLA**," Anti-Corrosive Compositions for Ships' Holds, Emigrant Fittings, Boot-tops, &c.

Sole Proprietors, R. T. BRUCE & Co., 5 Commercial Rd., Hull.

Telegraphic Address: "COMPO.," HULL.

STURTEVANT FANS FOR MECHANICAL DRAUGHT.

Sturtevant Engineering Company,
75, Queen Victoria Street, London.

WASTENEYS SMITH'S
PATENT "STOCKLESS" ANCHOR,
NEWCASTLE-ON-TYNE.

Most Sizes in Stock Ready for Immediate Delivery.
STOWS UP HAWSE PIPES, DISPENSING WITH "CATTING AND FISHING" GEAR.
Adopted by the British and other Governments and the leading Shipowners.
SHOULD BE SPECIFIED FOR ALL NEW VESSELS.
Is unquestionably the most efficient and trustworthy anchor in use.

ENGELBERT'S Pale Amber-Coloured Compound

ENGINE OILS,

FOR THE GENERAL LUBRICATION OF MARINE ENGINES

AND FOR ALL PURPOSES *EXCEPT CYLINDERS.*

Prices, Samples, and all Particulars on application.

ENGELBERT'S CYLINDER OIL

See Advertisement on Page xviii.

STORES—

NEWCASTLE-ON-TYNE: 9, Dean Street; Thos. Beynon, Agent. TYNE DOCK: Hudson Street; Thos. Beynon, Agent. CARDIFF: 97, Bute Road, W. Gibson, Agent. SWANSEA: Prince of Wales Dock; C. F. Stringer, Agent; East Dock Engineering Works; Ivor G. Williams, Agent. LIVERPOOL: 1, Cooper's Row; Urquhart, Thraves & Co., Agents. GREENOCK: 29, Brougham Street; R. Edelsten, Agent. BELFAST: Bridge Street; R. Patterson & Sons, Agents. NEWPORT: Alexandra Dock; C. H. Bailey, Agent. BARRY DOCK: Tyne Engine Works; C. H. Bailey, Agent. BRISTOL: 3 & 4, Narrow Quay; Pearce & Pinkney.

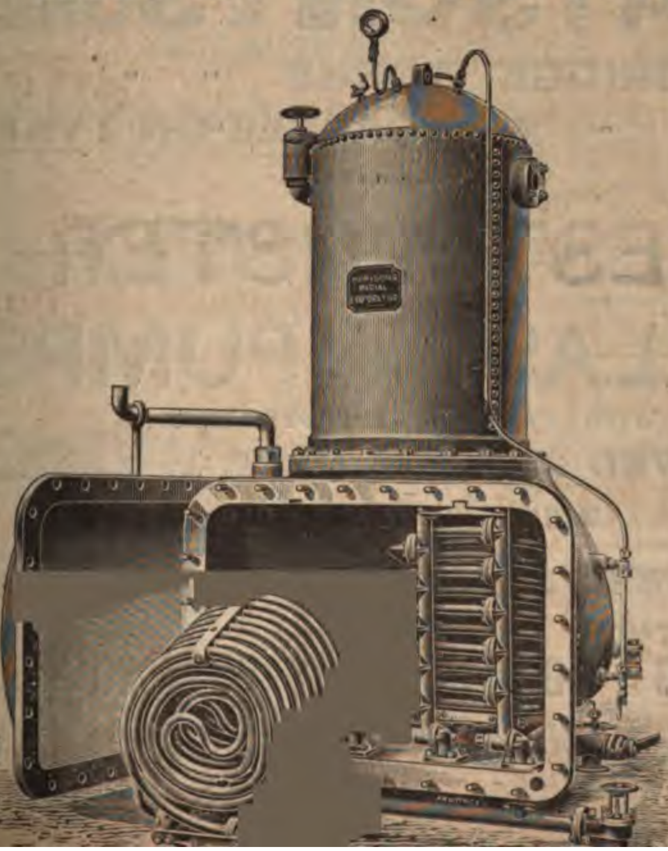
Manufacturers—

ENGELBERT & Co., 44 to 47, Bishopsgate St., London, E.C.

All Lubricants will, as heretofore, be invoiced by Messrs. ENGELBERT & Co., from London.

MORISON'S

RADIAL EVAPORATOR.



MANUFACTURERS—

T. RICHARDSON & SONS, LTD.,

HARTLEPOOL.

Contractors to War Office and Admiralty.

UNITED ALKALI CO., Limited,

LIVERPOOL.

ALLOYS,

"STELLA" BRAND.

MANGANESE-BRONZE.

Highest Quality for STRENGTH, ELASTICITY, and RESISTANCE TO CORROSION.

Especially adapted for Propellers Steering Gear, &c. Also in Rods, Bolts, Bars, & Sheets.

PHOSPHOR-BRONZE.

ANTI-FRICTION ALLOYS.

LOW IN PRICE. A1 IN QUALITY.

SEAMLESS COPPER JOINTINGS.

Any size and any shape, for any pressure. Indestructible, applied and removed without tools, no red lead, or other filling. For Cylinder Covers, Manhole-Mudhole Doors, Boiler and all Steam or Water Joints.

PATENT COPPER-RING SEATED STOP-VALVES (no regrinding).

PATENT GAUGE GLASS PROTECTORS.

Entirely enclosing Gauge Glass. Absolute Protection.

THE HULBURD ENGINEERING CO.,

Coppersmiths and Brassfounders, &c.

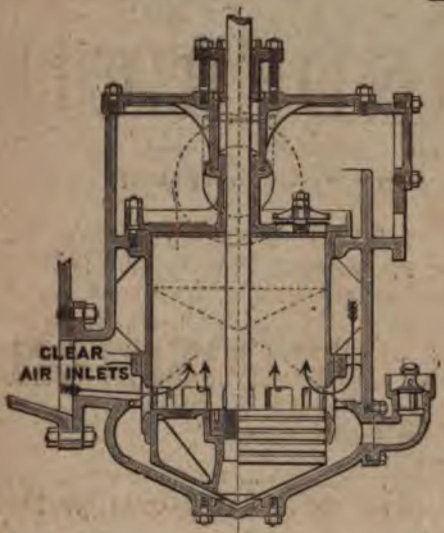
Contractors to Admiralty & principal Railways, &c.

150, LEADENHALL STREET, E.C.

RICHARDSON'S ENGINEERS' AGENCY.—EMPLOYERS having VACANCIES for Managers, Engineers, Draughtsmen and Foremen are invited to apply to the above, who always have on their books a number of first-class men SEEKING ENGAGEMENTS. Strict confidence observed.—65, Imperial Buildings, Ludgate

EDWARDS PATENT AIR PUMP.

No Foot or Bucket Valves. No Doors required in Barrel.



The whole of the valves can be examined, cleaned, or renewed without stopping the engines, loss of vacuum, or loss of fresh water. It is almost impossible for the failure of a valve to lead to a breakdown.

There being no foot valves, pressure is not required in the condenser to open them and drive the water up into the pump.

The water being driven into the barrel mechanically, the speed of the water must correspond with the speed of the bucket, however fast the pump be driven.

These pumps will deal efficiently with a large body of water, and are specially suitable for jet purposes.

Excellent results obtained in connection with out-board condensers.

A large number are at work on land and at sea, giving the greatest satisfaction.

63, Leadenhall Street, London, E.C.,
23rd December, 1898.

Dear Sir,—Thanks for yours of the 21st inst.

"Haiching." Your Air Pump on this vessel worked splendidly at the trial trip. Vacuum 29 in. during the whole of the time.

Yours faithfully, (Sgd.) A. J. DUDGEON.

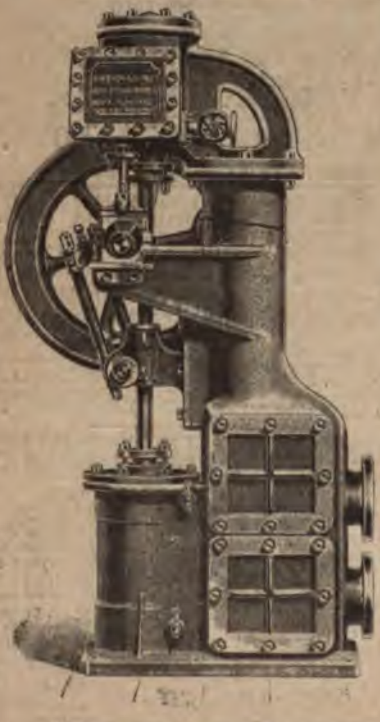
F. Edwards, Esq., 62, Bishopsgate Street, E.C.

FOR FURTHER PARTICULARS APPLY TO—

The EDWARDS AIR PUMP SYNDICATE, Ltd., 62, BISHOPSGATE ST. WITHIN, LONDON, E.C.

HENRY WATSON & SONS,

HIGH BRIDGE WORKS - -
- - NEWCASTLE-ON-TYNE.



WESTMINSTER BALLAST PUMPS

WITH PATENTED IMPROVEMENTS,

APPROVED SUCCESS OVER 15 YEARS.

MANY THOUSANDS SOLD.

Positive in Action. Strong, Simple,

AND

USES 50 to 60 per cent. LESS STEAM than A DUPLEX PUMP OF SAME CAPACITY.

TELEGRAMS: WATSONS, NEWCASTLE.

HIGHEST AWARD: GOLD MEDAL.

International Exhibition, CALCUTTA, 1884.

Holzapfel's Compositions Co., Limited,

NEWCASTLE-ON-TYNE,

Manufacturers and Sole Proprietors of

HOLZAPFEL'S

INTERNATIONAL ANTIFOULING COMPOSITION

Colour and appearance same as "RAHTJEN'S PATENT" COMPOSITION, but the INTERNATIONAL is much STRONGER and more EFFECTIVE as an ANTIFOULER.

HOLZAPFEL'S

National Antifouling Composition,

Specially prepared for North Atlantic, Baltic, and Home Trades.

Contractors to—
H.M. GOVERNMENT.
The INDIAN GOVERNMENT.
The AUSTRALIAN GOVERNMENTS.
The IMPERIAL AUSTRIAN GOVERNMENT.
The IMPERIAL RUSSIAN GOVERNMENT.

REGISTERED TRADE MARK.

Contractors to—
The UNITED STATES GOVERNMENT.
The IMPERIAL CHINESE and JAPANESE GOVERNMENTS.
The BRAZILIAN GOVERNMENT.
The ARGENTINE GOVERNMENT.

MANUFACTURERS OF HOLZAPFEL'S

Improved "Rahtjen's" Composition,

Supplied at Considerably Reduced Prices.

HOLZAPFEL'S "LAGOLINE" PAINTS

FOR GENERAL USE ON BOARD SHIP.

Quick Drying, Non-Explosive, Present an Enamel-like appearance Equal to Varnished Paints.

IN 10 ASSORTED COLOURS OR SHADES.

In drums of 1 cwt., and in tins of 14 and 7 lbs. each.

These Paints are cheap, lasting, and clean, handy and economical in use on board ship.

For Price Lists, Shade Cards, etc., apply—

HIGHEST AWARD: SILVER MEDAL.

LONDON - - -	57, Fenchurch Street.
LIVERPOOL - - -	3, Chapel Street.
GLASGOW - - -	12, Waterloo Street.
CARDIFF - - -	42, Mount Stuart Square.
W. HARTLEPOOL -	79, Church Street.
HAMBURG - - -	24, Kajen.
GENOA - - - -	2, Vico Mele.
NEW YORK - - -	Welles Building, 18, Broadway.

International Exhibition, Crystal Palace, 1884.

AGENCIES AT PRINCIPAL PORTS AT HOME AND ABROAD.

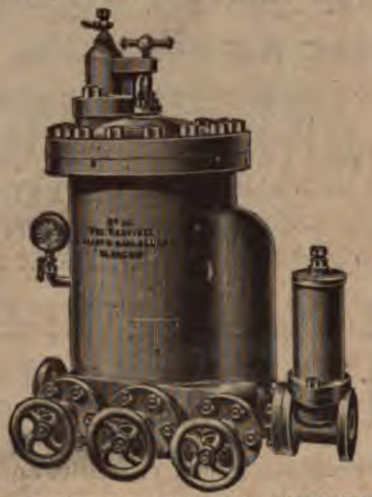
THE PATENT "SENTINEL" MULTIPLE
FEED WATER FILTER & OIL SEPARATOR

APPROVED BY THE BOARD OF TRADE;
Lloyd's Register; British Corporation Register; and Bureau Veritas.

GREAT EFFICIENCY.

LARGE FILTERING SURFACE.

GREAT SIMPLICITY.



GREAT DURABILITY.

MODERATE FIRST COST.

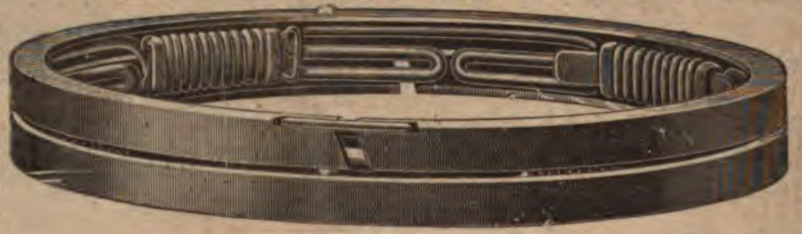
CHEAP MAINTENANCE.

FULL PARTICULARS ON APPLICATION.

ALLEY & MACLELLAN, SENTINEL WORKS, GLASGOW.

LOCKWOOD & CARLISLE'S IMPROVED PATENT DOUBLE-ACTION METALLIC
PISTON PACKING RINGS & SPRING.

The SPRING RINGS are SIMPLE and EFFICIENT, and are designed so as to have two distinct actions—one to press the Packing Rings outwards against the walls of the cylinder, and the other to press the Rings apart against the flat faces. Thus no inclined plane required in Rings.



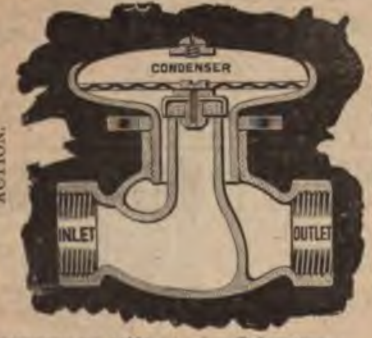
HIGHEST AWARD, Inventions Exhibition, 1885.

GOLD MEDAL, Liverpool, 1886.

Lockwood & Carlisle,
Limited,
EAGLE FOUNDRY, SHEFFIELD.
TELEGRAPHIC ADDRESS: PISTON, SHEFFIELD.

THE "MIDGET" STEAM TRAP For Pressure up to 120 lb.

PERFECTLY AUTOMATIC IN ACTION.



WIDE OPEN WHEN COLD.

THE SMALLEST, LIGHTEST, AND MOST COMPACT STEAM TRAP IN THE WORLD.

The "MIDGET" is perfectly automatic, and equally reliable at all pressures; having no sliding surfaces or frictional contact, the valve cannot possibly jam or get out of order, and once set requires no re-adjustment.

ADVANTAGES—

No. 1. Strength and durability.
" 2. Smaller number of parts than any other Steam Trap.
" 3. Reliable in action.
" 4. Uniform action of all temperatures and pressures.
No. 5. Compactness and neatness.
" 6. Non-liability to get out of order.
" 7. Being made entirely of gun-metal there is nothing to corrode.
" 8. Delivers water to any height according to pressure of steam.

Telephone No. 15294 (Bank.)

Telegrams—AMACO, LONDON.

JAS. ARMSTRONG & CO., Ld., 116, Queen Victoria Street, LONDON, E.C.

A. G. MUMFORD,

Culver Street Works, Colchester, England.

HE NEW
BLIC LIB
ASTOR, LENOX
TILDEN FOUNDA

Contractor to Admiralty, War Office, Crown Agent for Colonies, Spanish, Chilian, and other Foreign Governments.

SPECIALITIES.

HIGH SPEED MARINE ENGINES
PATENT WATER TUBE BOILERS

YACHT AND LAUNCH MACHINERY.

STEAM PUMPS FOR ALL SERVICES.

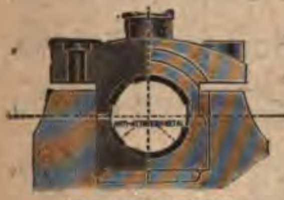
Send for full particulars of "Favorite" Type Donkey Pumps.

ON ADMIRALTY LIST FOR SUPPLY OF AUXILIARY MACHINERY FOR BATTLE SHIPS, &c.

ANTI-ATTRITION METAL.

The Best and Cheapest Metal for All

MARINE BRASSES.



Main Shaft Bearing.

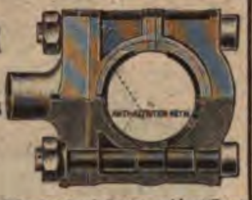
GIVES

INTERMINABLE WEAR

Uninjured Journals.

STANDS HEAVIEST PRESSURES AND HIGHEST SPEEDS.

SAVES IN LUBRICANT NEVER HEATS.



Big End of Connecting Rod.

SOLE MAKERS:

ANTI-ATTRITION METAL Co., Ltd., SOUTHWARK, LONDON, S.E.

INSTITUTE OF MARINE ENGINEERS.

Premises and Head Office,

58, ROMFORD ROAD, STRATFORD, E.

The Rooms are open every evening for the accommodation of Members.

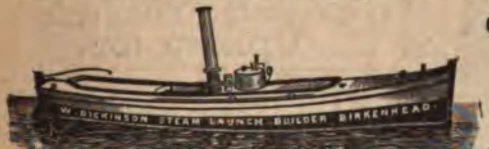
Circulating Library, Reading Room, Smoking Room, &c.

Proposal Form and Particulars of Membership on application.

President—John Inglis, L.L.D.
Hon. Treas.—F. W. Shorey. Hon. Sec.—Jas. Adamson.
Telegrams: "Gradation, London."

W. DICKINSON & SONS

STEAM LAUNCH, YACHT AND BOAT BUILDERS, &c.



W. DICKINSON STEAM LAUNCH BUILDER BIRKENHEAD

Contractors to the Admiralty, War Department, The Crown Agents for the Colonies, and Foreign Governments.

Telegraphic Address—
"Dickinson," Cathcart St., Birkenhead.

IT IS WORTH YOUR WHILE TO BUY DIRECT, therefore send for a trial barrel on approval of—

	Per Gal.
Reliance Best Marine Cylinder Lubricant......	1s. 9d.
" " Engine and Machinery Lubricant.....	1s. 9d.
" Second Qualities, 1s. 4d. Third Qualities	11½d.
Guaranteed not to pit boilers.	
" French Burning Colza Oil	1s. 9d.
" Safety 300 deg. Fire Test Lamp Oil........	10d.

f.a.s. any port in U.K.

THE RELIANCE LUBRICATING OIL CO.,
19 & 20, Water Lane, Great Tower St., London, E.C.
Tel. No., "Avenue, 5891." Tel. Address "Subastral, London." ABC Code used.

SNOWDON'S PATENT REMOVABLE ASBESTOS MATTRESSES FOR BOILER COVERING.

W. F. SNOWDON, 2, SIDE, NEWCASTLE-ON-TYNE.

Manufacturers of ASBESTOS and all classes of Covering, Asbestos Packing, India Rubber &c.

JOHN DICKINSON & SONS, Ltd.,

PALMER'S HILL ENGINE WORKS, SUNDERLAND.

MAKERS OF

COMPOUND AND TRI-COMPOUND

MARINE ENGINES AND BOILERS.

PATENTEES AND SOLE MAKERS OF

DICKINSON'S PATENT CRANK SHAFT,

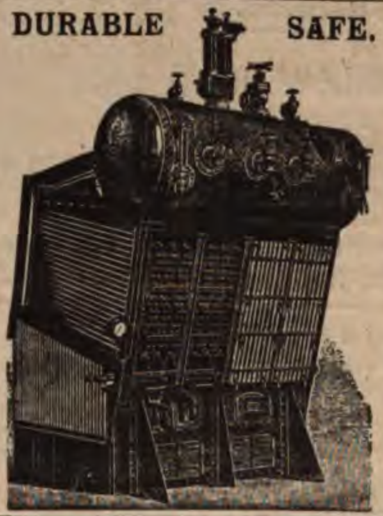
Specially suitable for Tri-Compound Marine Engines. Approved by Board of Trade, Lloyd's, and Bureau Veritas Registers.

Registered Telegraphic Address: "BEDE, SUNDERLAND."

BABCOCK & WILCOX, LTD.

FITTED
IN WARSHIPS,
PASSENGER
AND
CARGO VESSELS
DREDGERS,
YACHTS
AND TUGS.

DURABLE SAFE.



All Straight Tubes.
No Screwed Joints.
Large Water Space.
Large Steam Space.
Rapid Circulation.
Facility for Cleaning.
Minimum Cost of
Upkeep for
Highest Pressure.

MARINE WATER-TUBE BOILER.

LONDON:
147, Queen Victoria St.

WORKS:
RENFREW.

GLASGOW:
21, St. Vincent Place.

Save 80 % by using STERNOLINE BRICKS

For TUNNEL BEARINGS.

MOST ECONOMICAL, CLEANEST & BEST

Lubricant for Tunnel Bearings.

ADOPTED BY LEADING STEAMSHIP COMPANIES IN ALL PARTS OF THE WORLD.

Beware of Spurious Imitations. *Stocks at most British and Foreign Ports.*

SOLE MAKERS:

STERN BROS., 57, Gracechurch Street, London, E.C.,

And at GLASGOW.

Every Case is stamped with our Registered Trade Mark as above.

Telegraphic Address: "CENTUMVIR, LONDON."
Telephone: "Avenue, 2888." A B C Code.

MENZIES & CO., LTD., LEITH.

SHIPBUILDERS, ENGINEERS, & REPAIRERS.

(ON ADMIRALTY LIST.)

SHIP, ENGINE AND BOILER WORK OF EVERY DESCRIPTION UNDERTAKEN UNDER PERSONAL SUPERVISION.

TWO FIRST-CLASS PRIVATE DRY DOCKS.

Estimates given for Docking, Cleaning & Painting, &c., &c.

Telegraphic Address:—MENZIES, LEITH.
Telephone Number . . 536.

SAFETY BOILER WATER GAUGE-COCK CLEANER.

(WATSON'S PATENT.)

SOLE MAKERS
OF
GAUGE-COCK CLEANER.

MENZIES & Co., Ltd., Engineers & Shipbuilders, LEITH.

GARNER'S SPINAL REST.

Specially adapted for the comfort of all passengers on board ship, and undoubtedly superseding the old deck chair. This invention was patented by Mr. Garner after being advised to secure it by an eminent surgeon. It is simple, inexpensive, and effective; affords a continuous rest to all who want a recumbent or reclining position. Ordinarily made in DEAL, covered in Baize, with Mahogany or Teak Fittings, Price 25s. Made in Walnut, Oak, Mahogany, or Teak, upholstered in Velvet, price £8. Considered by eminent medical men as affording the best means of taking the weight off the spine. The combined actions of the seat and footboards taking away all the irksomeness and tediousness of reclining.

HENRY McGEORGE, Upholsterer & Cabinet Maker to the Trade, Silver Street, Bloomsbury, and 1, Bloomsbury Court, Holborn, London, W.C.

COKE to any Station. *Write for Prices.*

THE EVESON COAL & COKE CO., Ltd.,
BIRMINGHAM.

THE BEST BOILER APPLIANCES.

- **Mudd's Evaporators.**
- **Edmiston's Feed Filters.**
- **Von Essen's Tube Cleaners.**
- **Hannay's Electrogens.**
- **Wheeler's Condensers.**

Write for Particulars.

THE GLASGOW PATENTS COMPANY, Limited,
23, HOPE STREET, GLASGOW.
Works: KINNING PARK, GLASGOW. Agencies at all Ports.

ENGINEERING WORKS
Published by THOMAS REED & Co.,
184, HIGH STREET WEST, SUNDERLAND.

New Edition, the 16th, Revised and Enlarged. Containing NEW QUESTIONS Just Issued.
REED'S ENGINEERS' HANDBOOK
TO THE BOARD OF TRADE EXAMINATIONS, with 344 Diagrams, and 36 Large Plates. Price 14s. Post Free.
The KEY to the 16th Edition of REED'S ENGINEERS' HANDBOOK,
Containing all the Questions in the Examination Papers, fully worked out. Price 7s. 6d., post free.

REED'S GUIDE to the Board of Trade Examinations for EXTRA FIRST-CLASS ENGINEERS.
Containing 220 Problems Fully Worked Out, also 130 Diagrams and 13 Large Plates. Third Edition, 14s., Post Free.

REED'S POLYGLOT GUIDE to the Marine Engine, containing the names of 729 Parts in English, French, German, and Norwegian, and an Alphabetical Index in each Language, &c. Price 10s., Post Free.

JUST PUBLISHED. On a Sheet 43 in. by 33 in., in Cloth Case, Price 6s., Post Free. On Cloth and Rollers, Price 10s.
REED'S DRAWINGS OF TYPES OF STEAMSHIPS
And an Index to every part of each Vessel (in all upwards of 750 References).
REED'S SCREW AND WORM-WHEEL CUTTING UP TO DATE. Price 2/6, post free.

Price 2s. Post Free.
ELEMENTARY QUESTIONS & ANSWERS.
Just Published. Price 2s. 6d. Post Free.
REED'S MARINE BOILERS, their Priming and General Management, including Water Tube Boilers. With 58 Illustrations. 2nd Edition. 4s. 6d., Post Free.
REED'S MARINE ENGINEERS' STOCK, REQUISITION, & PRIVATE LOG BOOK. Price 1s. 6d., Post Free. "A very useful work for Marine Engineers."
REED'S DISTANCE TABLES. Between Ports in all parts of the World. Price 6d., Post Free.

New Edition, the 3rd, Revised and Enlarged.
REED'S USEFUL HINTS TO SEA-GOING ENGINEERS, AND HOW TO REPAIR BREAKDOWNS, with 36 Diagrams and 4 Plates. 3s. 6d., Post Free.
DRAWINGS OF A TRIPLE EXPANSION ENGINE, and the Pipe Arrangements on 2 Sheets. With Index to all parts. In Case, price 3s. 6d., Post Free.
WYLIE ON IRON & STEEL FOUNDING. Price 5s., Post Free.
REED'S FLAGS AND FUNNELS OF STEAMERS. In a Book. New Edition, 2nd. Price 3s. 6d., Post Free.

W. F. STANLEY,
Mathematical Instrument Manufacturer to H.M's Government Council of India, Science and Art Department, Admiralty, &c.
MATHEMATICAL DRAWING & SURVEYING INSTRUMENTS of every description, of the highest quality and finish at the most moderate prices.—Specialities for Ship Architects, Integrators, Weights and Splines, Ship curves in Sets 9, 15, 40 and 80. Special Boards, Base Scales, Gallows Squares, &c. Price List post free. Engine Divider to the Trade.—Address:
Great Turnstile, Holborn, London, W.C.

THE MARINE ENGINEER
Yearly Subscription is 7s. 6d. (Payable in Advance),
Commencing from any month ordered.
THIS Nº (APRIL COMMENCES VOL. XXI.

BLYTH SHIPBUILDING COMPANY, Limtd.
BLYTH, NORTHUMBERLAND.
Iron and Steel Shipbuilders, Ship, Engine and Boiler Repairers.
GRAVING DOCKS 350 & 330 FEET LONG RESPECTIVELY.
TELEGRAMS : "SHIPYARD."

GRICE, GRICE & SON
BRASS & COPPER
CONTRACTORS TO HER MAJESTY'S GOVERNMENT
LOCO &
CONDENSER
TUBES
BIRMINGHAM.

HIGHEST AWARD:
GOLD MEDAL.

Holzapfel's Compositions Co., Limited,

NEWCASTLE-ON-TYNE,

Manufacturers and Sole Proprietors of

International Exhibition,
CALCUTTA, 1884.

HOLZAPFEL'S

INTERNATIONAL ANTIFOULING COMPOSITION

Colour and appearance same as "RAHTJEN'S PATENT" COMPOSITION, but the INTERNATIONAL is much STRONGER and more EFFECTIVE as an ANTIFOULER.

HOLZAPFEL'S

National Antifouling Composition,

Specially prepared for North Atlantic, Baltic, and Home Trades.

Contractors to—
H.M. GOVERNMENT.
The INDIAN GOVERNMENT.
The AUSTRALIAN GOVERNMENTS.
The IMPERIAL AUSTRIAN GOVERNMENT.
The IMPERIAL RUSSIAN GOVERNMENT.

REGISTERED TRADE MARK.

Contractors to—
The UNITED STATES GOVERNMENT.
The IMPERIAL CHINESE and JAPANESE GOVERNMENTS.
The BRAZILIAN GOVERNMENT.
The ARGENTINE GOVERNMENT.

MANUFACTURERS OF HOLZAPFEL'S

Improved "Rahtjen's" Composition,

Supplied at Considerably Reduced Prices.

HOLZAPFEL'S "LAGOLINE" PAINTS

FOR GENERAL USE ON BOARD SHIP.

Quick-Drying, Non-Explosive, Present an Enamel-like appearance Equal to Varnished Paints.

IN 10 ASSORTED COLOURS OR SHADES.

In drums of 1 cwt., and in tins of 14 and 7 lbs. each.

These Paints are cheap, lasting, and clean, handy and economical in use on board ship.

For Price Lists, Shade Cards, etc., apply—

HIGHEST AWARD:
SILVER MEDAL.

International Exhibition,
Crystal Palace, 1884.

LONDON - - - 57, Fenchurch Street.
LIVERPOOL - - - 3, Chapel Street.
GLASGOW - - - 12, Waterloo Street.
CARDIFF - - - 42, Mount Stuart Square.
W. HARTLEPOOL - 79, Church Street.
HAMBURG - - - 24, Kajen.
GENOA - - - - 2, Vico Mele.
NEW YORK - - - Welles Building, 18, Broadway.

AGENCIES AT PRINCIPAL PORTS AT HOME AND ABROAD.

TUCK'S

GENUINE PACKINGS

FOR ALL CLASSES OF STEAM ENGINES.

INDIA-RUBBER GOODS

FOR MARINE WORK.

TRADE

CAOUTCHOUC

MARK.

ASBESTOS GOODS

PACKINGS, MATTRESSES, &c.

LEATHER HOSE & BELTING

LONDON: 116, Cannon St.
LIVERPOOL: 42, Chapel Street.
CARDIFF: 103, Bute Docks.
DUBLIN: Lower Abbey St.
NEWPORT (Mon.): Alexandra Dock.
BARRY: Barry Dock.
MELBOURNE: 456, Flinders Street.

CONTRACTORS TO BRITISH & FOREIGN GOVERNMENTS.

DARLINGTON FORGE COMPANY, LTD.,
DARLINGTON.

STEEL CASTINGS,
STEEL AND IRON
FORGINGS.
ANY WEIGHT UP TO 50 TONS.

CASTINGS, FOR MARINE WORK, PROPELLER BLADES AND BOSSES, HAWSE PIPES, DREDGER BUCKETS, TUMBLERS, SLIDE BLOCKS AND BARS, MAST CAPS, TILLERS, &c., &c.

IRON AND STEEL FORGINGS, CRANKS, CRANK SHAFTS, STEMS, STERN FRAMES, RUDDERS, KEELS, PISTON AND CONNECTING RODS, SCREW SHAFTING, &c., &c.

ALL THE ABOVE CAN BE HAD MACHINED COMPLETE.

CAMPBELL & CALDERWOOD,

SOHO ENGINE WORKS,
PAISLEY.

MAKERS OF PUMPS OF ALL KINDS.

HIGH SPEED ENGINES AND FANS.

SCREW ENGINES.

SIDE AND STERN WHEEL MACHINERY.

BEALL'S DEVIASCOPE.
As used by the Board of Trade.
A model practically illustrating the Deviation of the Compass, showing all the various co-efficients and their compensation.

Handbook to the above - - - - One Shilling.
SOLE MANUFACTURERS:
H. HUGHES & SON, Marine Opticians,
59, FENCHURCH STREET, LONDON.

H. HUGHES AND SON'S COMPLETE SALINOMETER. This very complete form of Salinometer comprises an improved copper pot, with a long wooden handle, to prevent scalding when drawing off, a gilt metal Salinometer, a glass ditto, and Thermometer, the whole of which pack in the copper pot when not in use. Price, complete with directions, 28s. 59, Fenchurch Street, London.

JOSEPH SCARR,
IRON AND STEEL SHIPBUILDER, AND REPAIRER,
TUG AND BARGE BUILDER,
GROVEHILL, BEVERLEY.

National Telephone, BEVERLEY, No. 16. Telegrams—SCARR, BEVERLEY.

BOARD OF TRADE.

To Sea-Going Engineers.
BOARD OF TRADE EXAMINATIONS.
W. H. THORN,
Member N.E.C. Inst. Engineers and Shipbuilders,
Author of "Reed's Engineers' Handbook," "Reed's Extra Chief's Guide," &c., &c.
5, WATERVILLE TERRACE,
NORTH SHIELDS.

Prepares Engineers for passing for 2nd, 1st, Extra 1st, Board of Trade, Lloyd's Examinations and Assistant Probationary Engineer for temporary service in the Navy, either at home or in the Colonies.

Tuition by Correspondence.

Mr. THORN has perfected a system of tuition by post, which has in all cases given great satisfaction. There is no longer any need for Engineers to lose money by leaving their ships and staying weeks on shore. W. H T.'s method of preparation by correspondence is PERFECT. Syllabus and particulars post free to any address.

This School is one where Extras are prepared for Examination, by THOROUGH SYSTEMATIC training, not "cramming."

At the January (1898) Examination for Extra First Class Engineers, out of NINE successful candidates, SEVEN were from this school, and of these, FIVE PASSED THE FIRST TIME OF GOING UP, MAKING FIFTY-SEVEN SUCCESSES ALTOGETHER.

90 per cent of Pupils pass the first time.
The OLDEST ESTABLISHED and MOST SUCCESSFUL School in the Kingdom.

HAWTHORN'S
Marine Engineering & Mathematical Academy,
(Established 1888.)
41, EAST INDIA DOCK ROAD, POPLAR, E.
Principal - J. HAWTHORN.
M. I. Mar. E. Extra Chief Engineer. Fellow R. Met. Soc. Memb. Soc. Arts. 1st Medallist in Navigation from Royal Naval Schools, Greenwich.

Engineers entering this School receive a thorough preparation from a practical sea-going Engineer of 15 years' service.

Candidates prepared for 2nd Class. 1st Class, and Extra Chief Certificates.

Personal Lectures, accompanied by Diagrams, on the Verbals and Elementaries twice a week.

Candidates Successfully Prepared by Correspondence.
Hours: 10 a.m. to 1 p.m.; 2 p.m. to 4.30 p.m.
EVENING CLASSES are held on Tuesday, Wednesday, Thursday and Friday. Hours: 7 p.m. to 9 p.m.

Summary of results from this Academy during the past eight years:—

Extra Chiefs,	B. T. Surveyors,	1st Class,	2nd Class,
13.	8.	656.	834.

95 per cent. of which passed on first trial.

LEASK'S
MARINE ACADEMY,
91, Minories, Tower Hill, London, E.

OUR UNIQUE SYSTEM OF EDUCATION,
includes everything required at the Examination, and produces results far ahead of any other.
VERBALS A SPECIAL FEATURE.
These embrace Indicator Diagrams, Setting of Slide Valves, Geared and Oscillating Engines, Boilers, Testing of Water Gauge, Salting, Pitting, Corrosion, Scaling, Priming, Breakdowns, and all other practical subjects included in the Verbal Examination.
OUR CORRESPONDENCE SYSTEM,
which obviates the necessity of leaving the ship to pass, is highly appreciated by Engineers all over the Globe.
IT WILL SAVE YOU POUNDS. Try it.

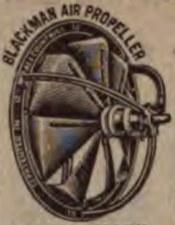
Principal Tutor: A. RITCHIE LEASK,
Consulting Marine Engineer & Surveyor,
Author of "Triple-Expansion Engines and Boilers," "Breakdowns at Sea," "Refrigerating Machinery," &c.
Write for LEASK'S ENGINEERS' HANDBOOK, and get full particulars & specimen papers, gratis & post free.

PRITCHARD'S MARINE ENGINEERING ACADEMY,
8, WALTON ROAD, LIVERPOOL.
Principal: E. L. PRITCHARD (Extra Chief Engineer).

THE SPECIAL ATTENTION of all Engineer Candidates who are desirous of presenting themselves for any grade of Board of Trade Certificates of competency is directed to the high standard of efficiency of the System of Tuition followed at this Academy. At the April Examination for Extras, out of six successful, three were from this Academy, and passed first trial.

Terms on application, will be forwarded to any part of the world.

THE
BLACKMAN
FOR
VENTILATING STEAMERS.



TRADE MARK

Driven direct by small Steam Engine, or combined with Electric Motor.

BLACKMAN VENTILATING CO., LTD.,
63, FORE ST., LONDON, E.C., and Branches.

WANTED
SCRAP IRON AND STEEL
Of every description,
OLD METALS,
SHIP PLATES, BEAMS, ANGLES

ENGINES, BOILERS, MACHINE TOOLS,
Locomotives, Cranes, &c.

THOS. W. WARD
Albion Works, & Fitzalan Chambers, SHEFFIELD.

ALEX. WILSON,
172, FENCHURCH ST., LONDON, E.C.
Before ordering or purchasing a Launch, Yacht, Tug or Lighter, write for International List.
Telegrams: "INGENIEUR," LONDON.
FORMERLY OF VAUXHALL IRONWORKS.

GENUINE
VULCANIZED FIBRE

SHEETS	VALVES
TUBES	WASHERS
RODS	PACKINGS
STAPLES	SHIELDS

MOSSES & MITCHELL
68. 69. 70 & 71
CHISWELL St LONDON E.C.

WM. & A. NUNN,
SHADWELL, LONDON, E.
SHIP LAMP MAKERS
AND
NAVAL BRASSFOUNDERS.
SOLE MAKERS OF
"ROBERTSON PATENT BOAT ROWLOCK."
"COLOMB'S FLASHING SIGNALS."
"HOLMES' DISTRESS SIGNAL LIGHTS."
SHIP CHANDLERS AND BLOCKMAKERS.
Telegraphic Address: "FLASHING," LONDON.

A. RUTHERFORD & CO.,
Neptune Works, BIRKENHEAD,
Shipbuilders and Repairers, Engineers and Boiler Makers.

Telegrams:— "Neptune, BIRKENHEAD."

BUILDERS TO THE BRITISH AND FOREIGN ADMIRALTIES AND THE ROYAL NATIONAL LIFEBOAT INSTITUTION.
Every Description of Launch, Barge, Lighter, Surf Boat, &c., &c.

GAUGE GLASSES.
GUILBERT-MARTIN,
Represented by ARTHUR HAMBURGER,
1 & 2, FALCON STREET, LONDON. E.C.
Manufacturer of Gauge Glasses for Steam Boilers, also Glass Tubes for Chemical and other purposes. Enamels for Iron (Cast and Wrought) and all Metals.

Inventor and Patentee of the BEACON (red-reflecting) gauge glass. With this glass the height of the water in a boiler can be seen at a glance, and will be found invaluable in dark and confined stoke-holes the level of the water being as clearly discernible in semi-obscurity as in full daylight. The glasses have been adopted by most of the Atlantic-going steamers, also by the Continental Railway Companies.

INDEX TO ADVERTISEMENTS.

	PAGE
Ailsa Shipbuilding Co.	xxvi
Alley & Maclellan, The "Sentinel" Feed Water Filter, &c.	vi
Alexander, E. P. & Son, Patent Agents	i
Anglo-American Boiler Solvent Co.	xxxiii
Anglo-American Rope and Oakum Co.	xxviii
Anti-Attrition Metal Co., Limited	vii
Armstrong, J. & Co., Ltd. (The Midget & Reservoir Steam Trap)	vi & xxxiii
Ashton Valve Co.	xx
Aspinall's Patent Governor Co	xxviii
Auld, David & Son, Steam Reducing Valves	xxx
Babcock & Wilcox, Ltd	viii
Bailey, W. H. & Co., Ltd.	xx
Beeton & Co., Commission Agents, &c.	xxvi
Blackman Ventilating Co., Ltd.	xiv
Blyth Shipbuilding Co., Ltd.	x
Broughton Copper Co., Limited	i
Bruce, R. T. & Co., "Nomos" and "Farola"	ii
Bull's Metal and Melloid Company	xvii
Caird & Rayner, Patent Automatic Evaporator	xxxi
Cammell, Chas. & Co., Ltd. (Cyclops Steel and Iron)	xxxiv
Campbell & Calderwood, Engineers and Boilermakers	xiii
Carrick & Wardale, Steam Pumps	xx
Casey, James	xxii
Chadburn's Ships' Engine and Steering Telegraphs	xxx
Chaplin, G. H. (Self-Lubricating Packings)	xx
Cochran & Co., Patent Vertical Multitubular Boilers	xix
Combination Metallic Valve and Packing Co.	xxiv
Crane's Oils for Marine Use	i
Crosby Lockwood & Son, Publishers	xi
Darlington Forge Co., Limited, Darlington	xiii
Davis & Co., Ltd., Davis Patent Steam and Hand Steering Gears	xx
Davis, R. P. & Co., Manufacturers of Non-Conducting Cement	xxviii
Delta Metal Company, Limited	i
Dickinson, John, & Sons, Limited	viii
Dickinson, William, Steam Launch and Boat Builder	vii
Donkin & Co.	xix
Drake, L. H. & Son (Patent Propellers)	xxiv
Drysdale & Co., Engineers	xxx
Eadie, Jas. & Sons, Tubes	i
Edison & Swan United Electric Light Co., Ltd.	xv
Edwards' Air Pump Syndicate, Ltd.	iv
Engelbert & Co., Engelbert's Lubricator	iii & xviii
Eveson Coal & Coke Co.	ix
Fell & James, Patent Agents	i
Glasgow Patents Co., Ltd.	xi
Grice Grice & Son, Brass Locomotive Tubes	x
Guilbert-Martin, Gauge Glasses	xiv
Harrison's Engine Co., Ltd.	ii
Hawthorn's Engineering Academy	xiv
Hay's Waterproof (Marine) Glue	xxx
Heath & Co. Ltd., "Hezzanith" Standard Binnacle and Compass	xxi
Holmes, J. H., & Co., "Castle" Dynamos	xxxiii
Holzapfel's Composition Company, Limited, Anti-Fouling Composition	i & v
Howden, James & Co., Engineers	xxvii
Hughes & Son, Indicator Diagrams, &c.	xiii & xx
Hulburd Engineering Company	iii
Institute of Marine Engineers	vii
Inventors' Medium, Ltd.	i
Jensen & Son, Patent Agents	i
Kaye, Jos. & Sons, Ltd.	xxix
Kelly's Directories, Ltd.,	xxxii
Lancaster & Tonge, Ltd., Engineers	xviii
Leask, A. Ritchie (Marine Academy	xiv
Leask, A. Ritchie, Publishers	xi
Linde British Refrigeration Co., Limited	xviii
Lloyd & Lloyd, Ltd. (Iron and Steel Tubes)	i
Lockwood & Carlisle, Ltd.	vi
Longmans, Green & Co.	xi
McGeorge Henry (Cabinet Maker, &c.)	ix
M'Knight, S. & Co., Ltd.	xxiv
McInnes, Anti-Corrosive and Anti-Fouling Compositions	xxvi
Magnolia Anti-Friction Metal Co. of Great Britain, Ltd.	i
Menzies & Co., Ltd., Leith	ix
Metallic Valve Co.	xxii
Moore, J. G. & Co., Engineers, &c.	xxix
Mosses & Mitchell	xiv
Mumford, A. G., Water Tube Boilers, &c., &c.	vii
Noble & Lund	xxiv
Normand, A. & Co., Engineers and Shipbuilders	xxiii
Normandy's Patent Marine Aerated Fresh Water Co., Ltd.	xxi
North British Rubber Company, Limited	xvi
Nunn, W. & A.	xiv
Palmer's Shipbuilding and Iron Co., Ltd.	xxviii
Penarth Shipbuilding and Ship Repairing Co., Ltd.	xxxi
Phosphor Bronze Co., Ltd., Phosphor Bronze	i & xxxvi
Potts, W. J., Bergen's Marine Engineer	i
Pritchard's Marine Engineering Academy	xiv
Ray Thos. (Pallion Forge)	xxvii
Redpath & Paris	xxii
Reed, Thos. & Co., Reed's Handbook to the Marine Board Examination	i & x
Reid, W. & Co.	xxvi
Reliance Lubricating Oil Co.	vii
Richardson's Engineers' Agency	iii
Richardson, T. & Sons (Morison's Evaporator)	iii
Robertson & Outram	xxiii
Ross & Duncan, Shipbuilders	i
Rutherford, A. & Co.	xiv
Scarr, Jos., Shipbuilder and Ship Repairer, &c.	xiii
Schichau, F., Engineer and Shipbuilder	xxv
Simons, Wm. & Co., Ltd., Engineers and Shipbuilders	xxix
Snowdon's Patent Removable Abestos Mattresses	vii
Snowdon, Sons & Co., Ltd. (Snowdrift Lubricant)	xxvii
Societe Anonyme des Forges et Chantiers de la Mediterranee	xxv
Speeding, J. & Co.	xxix
Spencer, John & Sons, Newburn Steel Works	xxxi
Stanley, W. F., Mathematical Instrument Manufacturer	x
Stern Bros.	ix
Suffield & Brown	xxix
Sturtevant Engineering Co.	ii
Suter, Hartmann & Rahtjen's Composition Co., Limited.	xvi
Symonds & Co.	xi
Taylor, S. T. & Sons	xxvii
Thorn, W. H.	xiv
Thornycroft, J. I. & Co., Steam Yacht & Launch Builders, &c.	i & xxii
Toward & Co.	xxvii
Treasure, J. B. & Co., Gauge Glasses	xxviii
Turner Bros., Asbestos	xvii
Tuck & Co., Limited, Patent Packing for Steam Engines	i, xii, & xix
Tyne Iron Shipbuilding Co., Limited	xxvii
United Alkali Co., Ltd.	iii
United States Metallic Packing Company, Limited	ii
Wailes, Dove & Co Ltd.	i & xxxv
White & Woodington, Patent Agents	i
Wallsend Slipway and Engineering Co.	
Ward, Thomas W.	xiv
Wasteneys Smith's Patent Stockless Anchor	ii
Watson H., & Sons	iv
Weir, G. & J., Ltd., Engineers	xvi
Wilkes, John, Mapplebeck & Co., Brass and Copper Tubes	i
Wilson, Alexr.	xiv
Worthington Pumping Engine Co.	xxxvi
Zynkara Co., Ld.	xxix

EDISON & SWAN UNITED ELECTRIC LIGHT Co., LTD.,

LARGEST MANUFACTURERS OF SHIP FITTINGS IN THE UNITED KINGDOM.

PROMPT DELIVERY. ESTIMATES FREE.

CONTRACTORS to the ADMIRALTY, FOREIGN NAVIES, & PRINCIPAL STEAMSHIP COMPANIES IN THE WORLD.

Head Office :—**EDISWAN BUILDINGS, QUEEN STREET, LONDON, E.C.**

Branches and Agencies throughout the United Kingdom and in every part of the World.

SUTER HARTMANN & RAHTJEN'S COMPOSITION CO., LTD.,
18, BILLITER STREET, LONDON, E.C.
MANUFACTURERS OF

HARTMANN'S RAHTJEN'S IMPROVED COMPOSITION
(THE RED HAND BRAND) FOR SHIPS' BOTTOMS, AND
HARTMANN'S (ANTI-CORROSIVE) **GREY PAINT**
Specially Prepared for Insides of Ships, and for Exposed Metal-work of all descriptions.

Branch Houses at LIVERPOOL, GLASGOW, NEWCASTLE-ON-TYNE & NEW YORK.
Agents at all important Ports throughout the World.

ANNUALLY SUPPLIED TO {Over **6,750,000** Tons of the Mercantile Marine,
And **1,100,000** Tons of the British and Foreign Navies.

WEIRS' PATENT MARINE FEED WATER HEATERS. EVAPORATORS. BOILER FEED PUMPS.
COMBINATION FEED CHECK VALVES—HYDROKINETERS for Boiler Circulation.

London Office: 1, BILLITER BUILDINGS, BILLITER STREET, E.C.

Particulars on Application.

G. & J. WEIR, LTD.,
CATHCART,
GLASGOW.

Telegrams:
"Giweir, Glasgow."
"Hydrokineter, London."

INDIARUBBER FURNISHINGS FOR STEAMSHIPS

THE
NORTH BRITISH RUBBER CO.,
LIMITED.
Are Extensive and *Bona-fide* Manufacturers of
Valves, Piston Packing, Mats,
AND OTHER
INDIARUBBER FURNISHINGS & SPECIALITIES
For the use of Engineers, Shipbuilders, etc.

Manufactory—
CASTLE MILLS, EDINBURGH.

Warehouses—
London, - - 57, Moorgate St., E.C.
Manchester, 69 & 71, Deansgate
Liverpool, - 9, Lord Street,
Leeds - - 65 & 66, Briggate.
Newcastle, - 39, Grainger Street.
Edinburgh, - 106, Princes Street
Glasgow - 106, Buchanan Street.

Patent High-Pressure Piston Packing—Metallic—Very Durable & Reliable.

MARINE VALVES—A New Special Quality—declared A1 by several Shipping Companies. Only about half thickness of ordinary Rubber Valves.

MANUFACTURERS OF WATERPROOF GARMENTS, SHOES, BOOTS, TUBING, HOSE, BELTING, SPRINGS, VULCANITE ARTICLES, AND ALMOST ALL INDIARUBBER PRODUCTS.

Contents.

PAGE
Editorial Notes ... 1
The Japanese Torpedo-Boat Destroyer (*Illustrated*) ... 4
The Prevention of Collisions at Sea ... 4
Institute of Naval Architects ... 4
Steam Pipes (*Illustrated*) ... 7
The Fleets of the Mail Lines ... 14
The Balancing of Engines (*Illustrated*) ... 17
Naval Matters—Past and Prospective ... 20
Marine Engineers' Notes ... 24
Electrical Notes ... 25
The Austrian Torpedo-Boats (*Illustrated*) ... 26
Floating of H.M.S. "Glory" ... 26
The Institution of Civil Engineers ... 28
The Institute of Marine Engineers ... 28
Naval Engineer Appointments ... 31
Industrial and Trade Notes ... 31
Trade Notes from the Tyne, Wear, Tees, Hartlepools, &c. ... 34
The Mersey ... 35
Thames ... 37
Belfast Trade Notes ... 37
North-West of England ... 38
Reviews ... 39
Launches and Trial Trips ... 40
Correspondence ... 46
Miscellaneous ... 46
Recent Applications for Patents, &c. ... 47
Board of Trade Examinations ... 48

With Double-Page Plate Supplement—First-Class Torpedo-Boat "Cobra," Built by Messrs. Yarrow & Co., Ltd., London.

NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W.G. Neal, Assoc. I.N.A., 3, Amen Corner, Paternoster Row, London, E.C. All communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

ADVERTISEMENTS.

All Advertisements and Business Communications must be addressed to the PUBLISHER, 3, Amen Corner, Paternoster Row, London, E.C., to whom all complaints respecting irregularities in delivery should be addressed. Advertisements must be sent in not later than the 25th of each month to insure insertion in the following number.

SCALE OF CHARGES.

Official Announcements, &c. - - - - -	1s. per line.
Trade Advertisements - - - - - -	9d. " "
Displayed Advertisements, per Inch single column -	5s.
" " " " double " -	10s.
" " " " treble " -	15s.
" " ¼ page - - -	30s.
" " ½ page - - -	60s.
" " Whole page - -	120s.

Series of Advertisements by arrangement.

All accounts are to be remitted to the Office, 3, Amen Corner, Paternoster Row, London, E.C. Cheques and P.O. Orders made payable to the "Marine Engineer."

SUBSCRIPTIONS.

The Subscription to the "MARINE ENGINEER," payable in advance, is (including postage) Seven Shillings and Sixpence per annum, from the above Office to all parts of the World, and from ny Month ordered. (April No. commences new Vol. each year.)

BULL'S METAL & MELLOID CO.
Registered Offices: Limited.
6, Jeffrey's Square, St. Mary Axe, London, E.C.
Telegrams :—" Melloid," London.
BULL'S METAL.—Propellers, Bars, Sheets, Pump Rods, Valve Spindles, Condenser Stays and Plates, &c.
MELLOID (Reg. Trade Mark and Patented) —Condenser Tubes, Plates and Stays, Boiler Tubes, Stays and Plates, Fire-box Plates, Bars, Sheets, Valves, &c.
WHITE METALS.—Babbitt's, Plastic, &c.

BULL'S METAL SOLID PROPELLERS,
Replacing Cast Iron, will effect an average increase in speed (on the same coal consumption) of
ABOUT ½ KNOT
in the case of large cargo boats.

WORKS: ROCHDALE

ASBESTOS GOODS.
Yarn, Cloth of every description, Cordage
Rope Packing, Millboard, Asbestos and
Rubber Cloth Packing, Sheeting,
Tape, Joints, &c.
Asbestos, Metallic, and Rubber Packing,
Sheeting, Tape, Joints, &c.

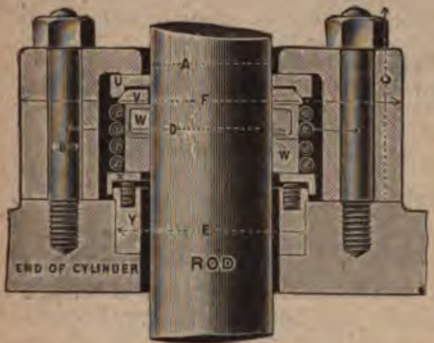
MISCELLANEOUS PACKINGS
OF EVERY DESCRIPTION.
Hemp and Cotton Packings, Chalk Packing,
Mineral Packing, Anti-Friction Packing,
&c., &c.

TURNER BROTHERS,
LONDON OFFICE: 46, Fenchurch Street.
Telegraphic Address: "Turners, Rochdale."
Telephone No. 3.
Spotland, ROCHDALE.
ADMIRALTY CONTRACTORS,
SPINNERS, WEAVERS, AND
MANUFACTURERS of ASBESTOS IN ALL ITS FORMS.

Manufacturers of SOLID WOVEN HAIR BELTING
FOR MAIN AND OTHER DRIVING.

REFRIGERATING AND
ICE-MAKING MACHINERY.
OVER 3,800 MACHINES SOLD.
OF WHICH THERE ARE OVER 500 IN USE ON BOARD SHIP.
THE LINDE BRITISH REFRIGERATION CO., LTD.,
35, QUEEN VICTORIA STREET, LONDON, E.C.
Telephone 1573. Telegrams—"SEPARATOR, LONDON."

THE "LANCASTER"
R.T.M.
METALLIC PACKINGS.



The "Lancaster" Packings have been introduced to meet the requirement for a *Metallic Packing* which shall be at once *simple,* and, at the same time, *perfectly efficient.* In the best existing forms of METALLIC PACKINGS hitherto made the metallic blocks are kept in position against the rod by means of a number of small springs, which are troublesome to manipulate and easily lost, thus causing much inconvenience. In the *"Lancaster" Packings* these are replaced by *one,* or in the larger Packings by *two springs,* which, completely encircling the block, press them to the rod with a *PERFECTLY EQUAL PRESSURE* at the same time leaving them free to give with any oscillation which may occur owing to the rod being out of truth with the cylinder. The Spring is *capable of being adjusted* without taking the Packings off, and can be *TIGHTENED IN THREE MINUTES* after the outer casing has been removed.

ALWAYS SENT ON APPROVAL.
LANCASTER & TONGE, Ltd.,
Engineers and Brassfounders, PENDLETON, MANCHESTER.

"ENGELBERT'S"
HIGH-CLASS ANTI-CORROSIVE
LUBRICANT,

For Engine Oils See advertisement page iii.

For Engine Oils See advertisement page iii.

FOR CYLINDERS AND VALVES,
HEAVY BEARINGS, SHAFTING, AND HIGH-SPEED MACHINERY.
Leaves no Dirt or Deposit about Piston, Boilers or Condensers.
GUARANTEED NOT TO "PIT" MARINE BOILERS.
INVALUABLE FOR COLD-AIR REFRIGERATORS.

Extensively used for ELECTRIC LIGHT WORK, Engines and Dynamos.

Price, Samples, and all particulars may be had of the Patentees and Sole Manufacturers,
ENGELBERT & CO., 44-47 BISHOPSGATE, LONDON, E.C.
Agents with Stock at Newcastle-on-Tyne, Tyne Dock, Cardiff, Barry, Swansea, Newport, Greenock, &c.

COCHRAN & CO., BIRKENHEAD.

Patent Vertical Multitubular BOILERS.

High Pressure Compound, Triple-Expansion ENGINES.

ady for Immediate Delivery.

STEAM YACHTS, LAUNCHES, &c.

In Stock and Progress.

PRICE LISTS POST FREE ON APPLICATION.

TUCK & CO., LIMITED,

SPECIALITIES.

TRIPLE PACKING.
MORRISON'S PATENT
For Triple Expansion Engines.
LONDON: 116, Cannon Street.

LEATHER HOSE AND BELTING.
LIVERPOOL: 42, Chapel Street.

TUCK'S PACKING
For Marine and Stationary Engines of all descriptions.
CARDIFF: 103, Bute Docks.

INDIARUBBER VALVES
For Air and Circulating Pumps,
WORKS: LONDON. LIVERPOOL CARDIFF.

NEWPORT: Alexandra Dock. DUBLIN: Lower Abbey St. MELBOURNE: 456, Flinders St.

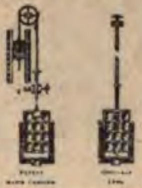
SEE ALSO PAGE XII.

DONKIN & CO, (LATE DONKIN & NICHOL).

CONTRACTORS TO THE ADMIRALTY.

ST. ANDREW'S WORKS, NEWCASTLE-UPON-TYNE.

No. 1—VERTICAL STEERING GEAR
Combined Hand and Steam fitted as above, or with Chain Drum.



BULKHEAD DOORS
Of every description.

ASH HOISTING ENGINE
With Patent Adjustable Automatic Cut-off Gear, as supplied to H.M. Battleships.

SHIPS' TELEGRAPH AND ALARM GEAR
of every description.

ASH HOISTING ENGINE
With Patent Adjustable Automatic Cut-off Gear, Twin Drums for working Two Ventilators.

No. 3—VERTICAL STEERING GEAR.
Combined Hand and Steam, for Aft Steering. With Controlling Shaft from Bridge to Poop.

No. 7—HORIZONTAL STEERING GEAR.
Steam only. With or without Bridge Connection.

No. 4—HORIZONTAL STEERING GEAR.
Combined Hand and Steam. Spur Gear to Hand Power.

No. 6—HORIZONTAL STEERING GEAR.
Combined Hand and Steam.
Thwartship Twin Drums. Also in modified form placed Aft of Engine Casing and worked by Steam only from Bridge.

No. 5—HORIZONTAL STEERING GEAR.
Combined Hand and Steam. Worm Gear to Hand Power.

No. 9—HORIZONTAL STEERING GEAR.
Steam only. Drum also side of Wheelhouse or Engine Casing.

VERTICAL HIGH SPEED ENGINE

ENCLOSED BLOWING FAN AND ENGINE.

ENCLOSED BLOWING FAN AND ENGINE.

OPEN EXHAUSTING FAN AND ENGINE.

ENCLOSED EXHAUSTING FAN AND ENGINE.

COAL WHIPPING ENGINE

WORKSHOP ENGINE
As supplied to H.M. [illegible]

BLOWING AND EXHAUSTING FANS OF EVERY DESCRIPTION IN WROUGHT AND CAST IRON, WITH DIRECT DRIVING VERTICAL OR HORIZONTAL ENGINES. FOR FORCED DRAUGHT, EXHAUSTING TANKS OF OIL STEAMERS, AND GENERAL VENTILATING PURPOSES.

ALWAYS IN STOCK OR IN PROGRESS

A Perfect Reducing Valve

AT LAST.

No Pistons.

No Dashpots.

Entirely Metallic.

The Foster PATENT
"FULL-BORE"
SIZES ½ IN.—18 IN. BORE.

W. H. BAILEY & Co., Ltd., MANCHESTER.

POP
SAFETY AND
WATER RELIEF
VALVES.

Write for List 9.

Our No. 15 Valve as Illustrated, for Launch Boilers.

ASHTON VALVE Co.
34, *Queen Street*,
LONDON, E.C.

INDICATOR DIAGRAMS.

For Engineers to keep a record of all Diagrams taken, interleaved with tracing paper, to take a tracing of the Diagram. Price 2s. 6d., by post 2s. 9d. H. HUGHES & SON, 59, Fenchurch Street, London.

REGISTERED
KOH-I-NOOR
TRADE MARK

CHAPLIN'S DIAMOND
SELF-LUBRICATING PACKINGS,
FOR
STEAM OR HYDRAULIC USE.
HIGH OR LOW PRESSURE.
Will not Cut or Groove the Rods.
LUBRICANT UNINJURED BY
HEAT, WATER, OR ACID.
THE MOST EFFECTIVE PACKING IN THE MARKET.

The Original true "DIAMOND" Packing of which so many inferior imitations have been lately passed off on the public.

PRICES AND PARTICULARS ON APPLICATION.

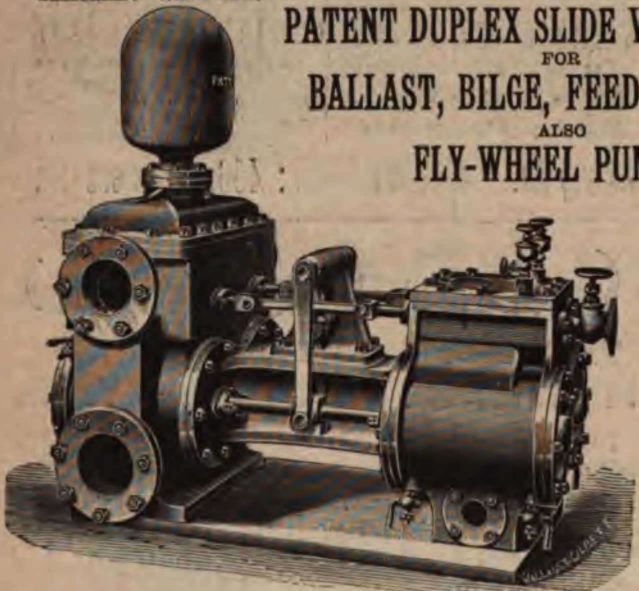
G. H. CHAPLIN,
12, ST. HELEN'S PLACE, BISHOPSGATE STREET,
LONDON, E.C.

CARRICK & WARDALE, REDHEUGH ENGINE WORKS, GATESHEAD
TELEGRAMS: "WARDALE,"

PATENT DUPLEX SLIDE VALVE PUMPS
FOR
BALLAST, BILGE, FEED, FIRE, Etc.,
ALSO
FLY-WHEEL PUMPS.

WRITE
FOR
PUMP
LISTS.

*ALWAYS
ON
STOCK.*



DAVIS & CO., LTD.,
Works—GARFORD ST., POPLAR, LONDON, E.
PATENT STEAM STEERING GEAR,
CAPSTAN & WINDLASS MAKERS.
GENERAL ENGINEERS.

Makers to the English and Foreign Governments for Vessels from Torpedo Boats up to Ironclads of 14,000 tons.
1,600 Merchant Ships fitted of all tonnages.

FRESH WATER from SEA WATER.

NORMANDY'S PATENT
DISTILLING MACHINERY

TWO GOLD MEDALS, London International Health Exhibition. 1884.

The Water produced is **PURE, COLD, CLEAR,** and agreeable to the **TASTE.**

NORMANDY'S PATENT EVAPORATORS and **CONDENSERS** for **STEAMERS** produce, from Sea Water, Cold Drinking Water of above quality when worked with the greasy steam from the main boilers, and at the same time will also supply Hot Fresh Water for Make-up Feed.

NORMANDY'S PATENT DISTILLING MACHINERY for **LAND STATIONS** produces at least 29 tons, or 6,500 gallons, of Water of above quality per ton of coal.

NORMANDY'S DISTILLING MACHINERY has been largely supplied to the English Admiralty, and to the German, Russian, Spanish, Dutch, Japanese, and other Governments. Also to the P. & O., Royal Mail, and many other Liner Companies and Yachts, including the Royal Yacht "Victoria and Albert." Also to Land Stations in various parts of the world.

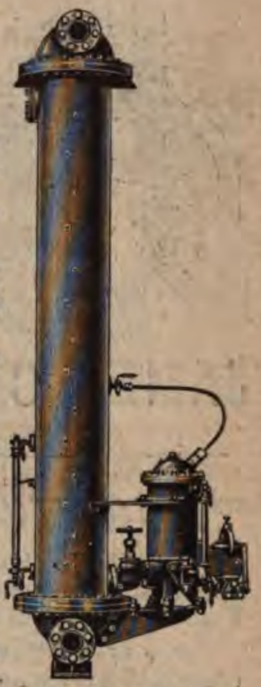
H.M.S. "Powerful," "Terrible," "Arrogant," "Furious," "Venus," "Diana," &c., &c., are also supplied with **NORMANDY'S COMPOUND DISTILLING MACHINERY.**

NORMANDY'S PATENT MARINE AERATED FRESH WATER CO., Ltd.,
Opposite Custom House Station, Victoria Dock Road, LONDON, E.

ALSO SOLE MAKERS OF
NORMAND'S PATENT

FEED WATER HEATER.

ADOPTED BY THE BRITISH AND OTHER GOVERNMENTS.



FEED HEATER.

THE "HEZZANITH" STANDARD BINNACLE, COMPASS & AZIMUTH INSTRUMENT.

Advantages:—

1st. An absolutely reliable Binnacle at *half the usual price.*

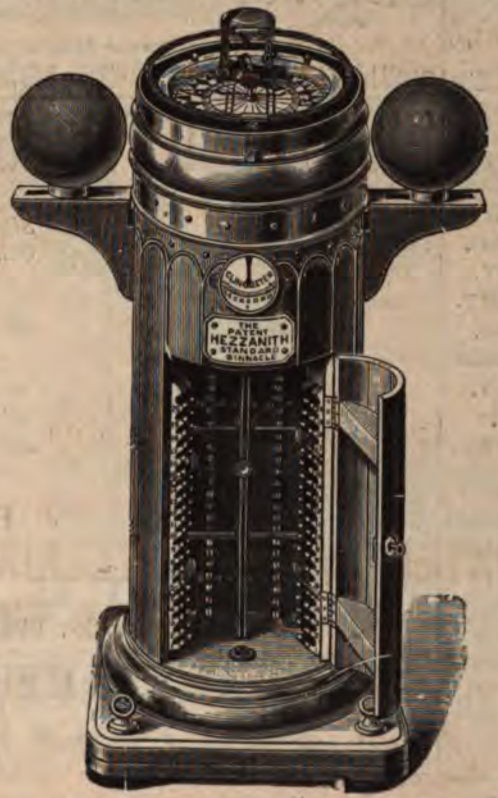
2nd. Patent *endless* silken spoke light card (Thomson's pattern).

3rd. A patent system, by which the magnets can be adjusted to precision without disturbing the card when moving the magnets.

4th. An Azimuth Instrument which can be adjusted and worked with ease.

5th. A Compass and Binnacle so complete in itself that any captain can, without aid, adjust it.

6th. All parts made of *best material*, forming an instrument which will stand "Tramp" wear and tear.


THE PATENT HEZZANITH STANDARD BINNACLE

Compasses fitted to the following steamers:—"Galena," "Navigation," "Chittagong," "Starlight," "Electra," "Daybreak," "Arana," "Pinta," "Balbao," "Dante," "Alvarado," "Gravina," "Bravo," "Pizarro," "Cortes," "Thomas Wayman," "Flambro," "Verax," "Glendower," "Bearsford" "Garth," &c.

And hundreds of others.

Also upon several Canadian Government Cruisers, including the last, the "*Lansdowne,*" Russian, Swedish, Danish, and Australian Colonies Cruisers, and Merchant Steamers, &c., &c.

S.S. "STARLIGHT":—"The two Patent Hezzanith Binnacles supplied to this ship have turned out first-class."
April, 1897. W. H. MILLER, Master.

Numberless Testimonials & Satisfactory Reports about every Binnacle supplied.

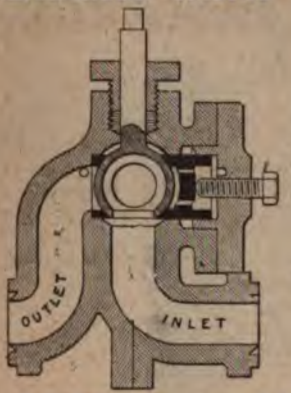
GUARANTEED FOR 12 MONTHS

Wholesale of the Manufacturers, **HEATH & CO., LTD.** *CRAYFORD LONDON. S.E.*

HYDRAULIC BALANCED VALVE.

CASEY'S PATENTS.

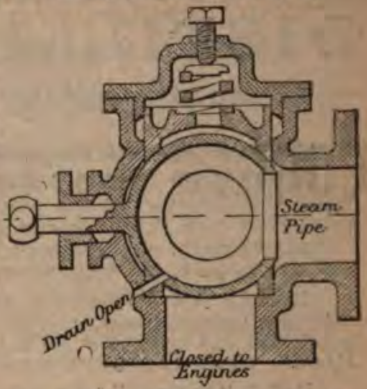
STEAM BALANCED VALVE.



GUARANTEED FOR 750 lbs. PRESSURE AND UPWARDS TO WORK IN SANDY OR GRITTY WATER FOR ONE YEAR.

COMBINED STOP & THROTTLE VALVE.

ANTI-PRIMING FOR ALL PRESSURES.



JAMES CASEY, Engineer, 10, PHILPOT LANE, LONDON, E.C.

Telegraphic Address: "VELOCEMENTE, LONDON."

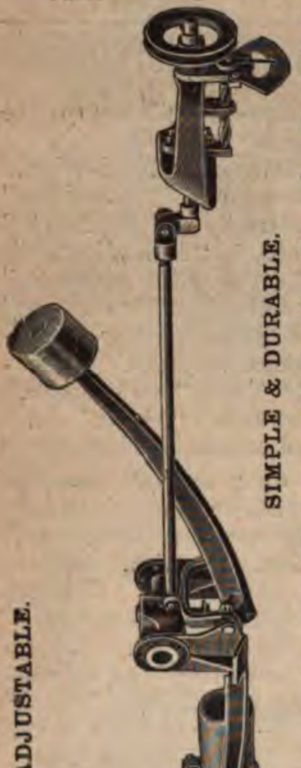
THORNYCROFT'S

PATENT AUTOMATIC

FEED REGULATOR

For Water-Tube Boilers,

INCREASES EFFICIENCY & ECONOMY.



SIMPLE & DURABLE.

ADJUSTABLE.

IS ESPECIALLY ADAPTED FOR

Marine Work

AND

ElectricSupply Stations.

Fitted to the Following Ships in

H.M. NAVY.

SPEEDY.
DARING.
DECOY.
ARDENT.
BOXER.
BRUISER.
HANDY.
HART.
HUNTER.

ALSO TO THE

IMP. GERMAN IRONCLAD "AEGIR"

ABOVE REPRESENTS

45,000 I.H.P.

JOHN I. THORNYCROFT & CO.

CHISWICK, LONDON.

KINGHORN'S

PATENT

METALLIC VALVES.

For ECONOMY and DURABILITY are not equalled by any other valves made, and can be easily fitted to existing pumps

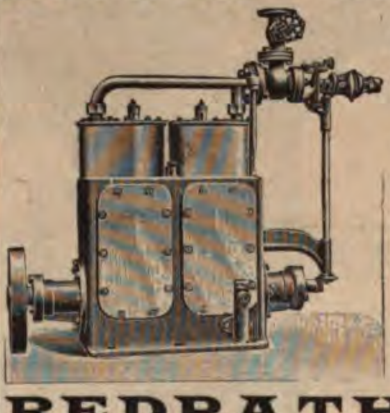
Are being largely used by the BRITISH and FOREIGN NAVIES and the Principal Steamship Lines.

For Particulars and Price Lists apply at the Offices of the

METALLIC VALVE CO., TOWER BUILDINGS, WATER STREET, LIVERPOOL.

HIGH-SPEED "NOISELESS" ENGINES

GUYOT'S PATENT.



Simple, Compound or Triple Expansion; Condensing or Non-Condensing; Single, Double or Triple Cranks.

GREAT SIMPLICITY OF CONSTRUCTION

ABSENCE OF VIBRATION.

Suitable for long continuous running; Automatic Lubrication; Great Economy of Oil; Minimum of Attendance.

FOR DYNAMO, FAN
And every other kind of Driving.

REDPATH & PARIS,

Lea Cut Ironworks, LIMEHOUSE, LONDON, E.

Contractors to Admiralty. Telegrams: "REDPATH, LIMEHOUSE, LONDON."

JOHN I. THORNYCROFT & CO.,

Steam Yacht & Launch Builders,

CHURCH WHARF, CHISWICK, LONDON, W.

YACHTS and LAUNCHES for SEA or RIVER SERVICE,

From 25 ft. to 250 ft. in Length, and Speeds from Ten to Twenty-seven knots per hour.

AUGUSTIN NORMAND & Co., ENGINEERS & SHIPBUILDERS,

HAVRE (FRANCE).

SOCIÉTÉ ANONYME DES

FORGES ET CHANTIERS DE LA MEDITERRANÉE.

HAVRE (FRANCE).

Fig. 1.

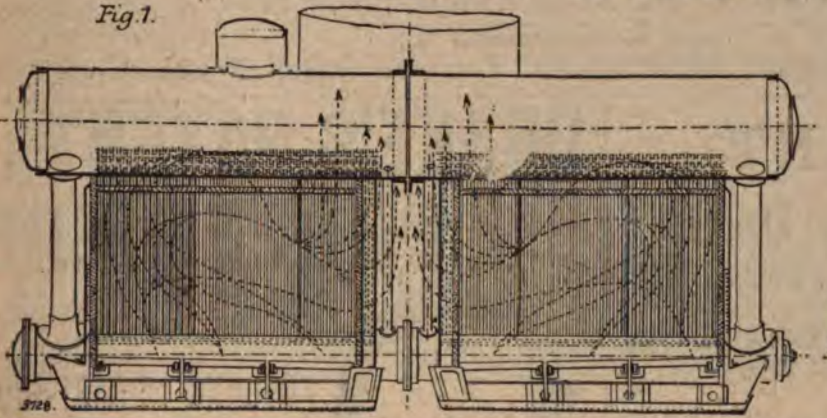
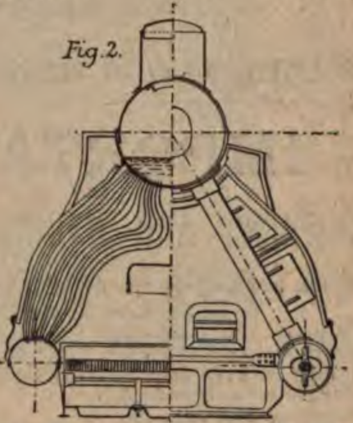


Fig. 2.



NORMAND-SIGAUDY'S PATENT WATER-TUBE BOILERS

FOR HIGH SPEED MAIL STEAMERS, LARGE YACHTS, CRUISERS AND BATTLESHIPS.

NORMAND-SIGAUDY'S PATENT FEED-WATER REGULATOR.

AUGUSTIN NORMAND & CO.,

ENGINEERS AND SHIPBUILDERS,

HAVRE (FRANCE).

NORMAND'S PATENT BOILERS,

Applied to the "Forban," the fastest torpedo-boat afloat.

NORMAND'S PATENT FEED HEATER.

15 to 20 per cent. Economy of Fuel.

NORMAND'S PATENT FEED DISTRIBUTING ARRANGEMENT.

NORMAND'S PATENT FEED-WATER FILTER,

Adopted by the French and other Governments. 700,000 I.H.P. already fitted with this Filter.

NORMAND'S PATENT CYLINDER RELIEF VALVES.

The consumption of Fuel in Normand's Torpedo-Boat Engines, which are fitted with the above appliances, has, in the Official Government trials, been repeatedly as low as 1·1 lbs. per I.H.P. per hour, at low speed, and 1·7 lbs. at maximum speed. The total weight of Engines, Boilers and Water has been brought down to 36 lbs. per I.H.P.

SOLE REPRESENTATIVES FOR GREAT BRITAIN :—[Telegraphic Address : EYEBOLTS, LONDON. Telephone : No. 128, Westminster.

ROBERTSON & OUTRAM, 28, VICTORIA ST., WESTMINSTER, S.W.

COMBINATION METALLIC PACKING

For Piston Rods, Valve Spindles, Pump Rods, &c.

Some of the Largest and Fastest War and Mercantile Ships Fitted.

SPECIAL MACHINE for TESTING PACKING UNDER STEAM before leaving the Works.
PROPRIETORS OF HEDLEY'S MECHANICAL LUBRICATORS.

Telegraphic Address—"COMBINATION, NEWCASTLE-ON-TYNE."

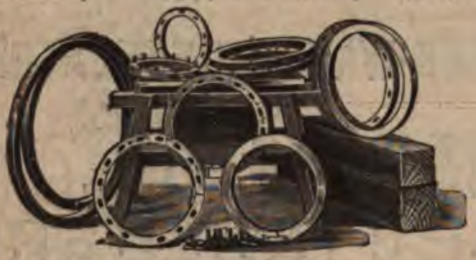
SOLE MANUFACTURERS:
THE COMBINATION METALLIC PACKING CO., Lombard Street, Newcastle-on-Tyne.

IMPORTANT
TO
SHIPOWNERS AND MARINE ENGINEERS.

When arranging specifications for Engines, be careful to specify

MUDD'S PATENT PISTON RINGS.

By their use a real economy is effected.
They are perfectly steamtight.
There is no wear apparent.
Friction is reduced to a minimum.
Cylinders keep their true form.
Thousands of Cylinders have been fitted with them, giving perfect results.



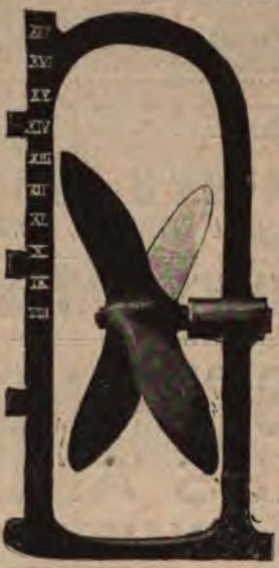
SOLE MANUFACTURERS:

NOBLE & LUND,
FELLING-ON-TYNE.

Telegrams—Lathes, Felling. *Nat. Telephone, 11023.*

AGENTS—
Liverpool—Jas. Bremner, 11, Drury Lane, Liverpool.
Glasgow—Albert J. Kinghorn, 12, Renfield Street, Glasgow.
Cardiff—John Chellow, Pembroke Buildings, Cardiff.

DRAKE'S PATENT PROPELLERS



SPECIALLY DESIGNED TO SUIT
All Classes of STEAMERS, Single or Twin-screws,
MANUFACTURED IN
BRONZE or CAST-IRON

Solid Propellers,
OR IN PARTS

It has been proved by SPEED TRIALS to be the
BEST PROPELLER YET INVENTED.

For economy, increase of speed, reduction of vibration, and backing powers,
IT HAS NO EQUAL.
Best results and Prompt Delivery Guaranteed.

Full Particulars on Application to
L. H. DRAKE & SON,
NAVAL ARCHITECTS AND MARINE ENGINEERS
157a, Fenchurch Street, London, E.C.

S. M'KNIGHT & CO., LTD., AYR.

WE REPAIR SHIPS

SHIPBUILDERS AND ENGINEERS.

SHIP AND ENGINE REPAIRERS.

All Kinds of Repairs Promptly and Efficiently Executed.

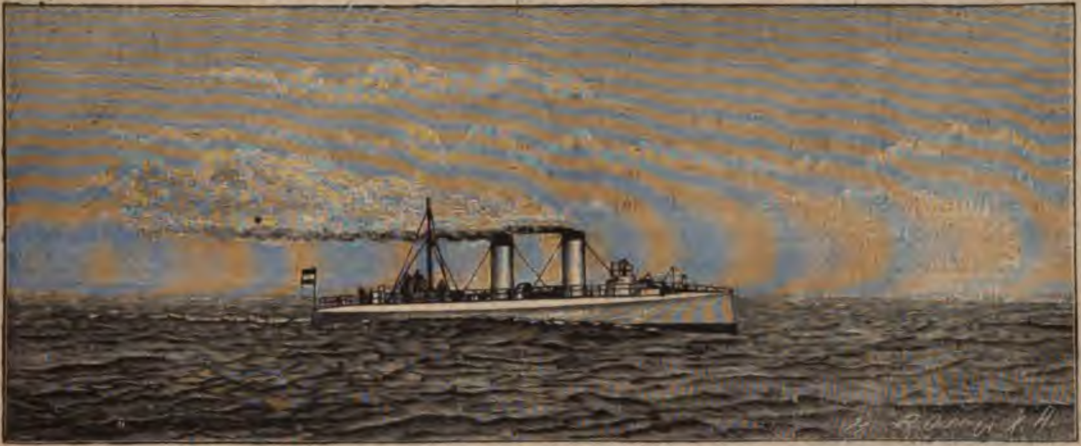
PATENT SLIP OF MOST MODERN TYPE CAPABLE OF TAKING ON VESSELS UP TO 2,000 TONS GROSS.
LENGTH OF SLIPWAY, 850 ft. CLEAR WIDTH, 54 ft. 2 ins.

ESTIMATES PROMPTLY ATTENDED TO.

SHIPBUILDING YARD AND SLIP DOCK, **AYR, SCOTLAND.**

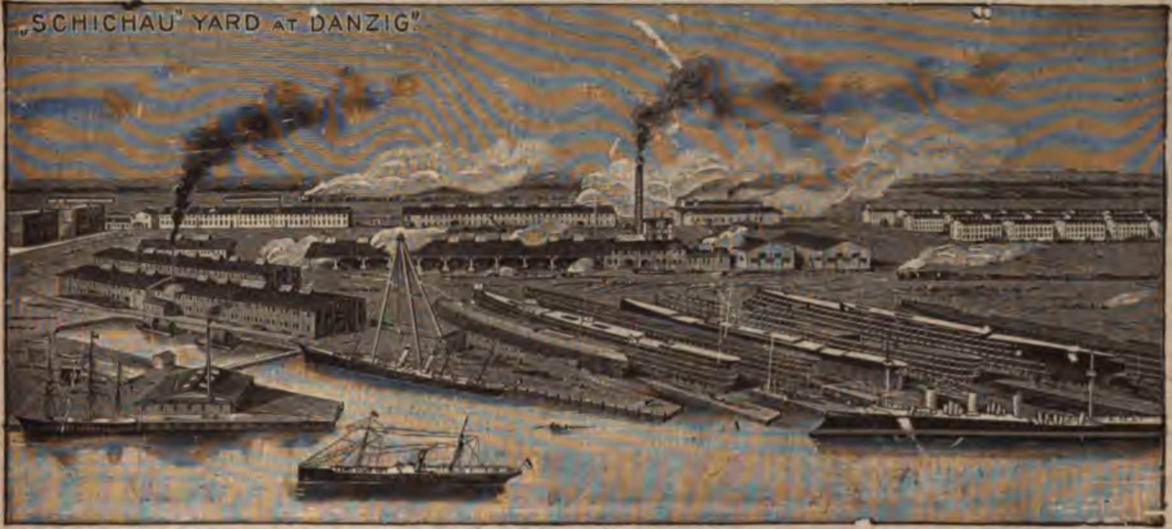
Telegrams: "SLIP, AYR
Telephone: No. 26.

F. SCHICHAU,
ENGINEER AND SHIPBUILDER,
ELBING, PRUSSIA.



TORPEDO BOAT DESTROYER
for the Imperial Chinese Navy.

Speed, with complete outfit, armament and 25 tons of coal in the bunkers, 35·2 knots—65·2 km., with 67 tons of coal 33·6 knots—62·2 km.


„SCHICHAU" YARD AT DANZIG."

HIGH SPEED PASSENGER STEAMERS.
For Sea and River Service.

THE WORKS WERE FOUNDED IN 1837, *AND HAVE CONSTRUCTED UP TO DATE*—

2,000 Steam Engines.
665 Steamers for Sea and River Service.
240 Torpedo Boats and Cruisers, with speeds from 20 to 36 knots per hour.
825 Marine ENGINES, among them:
500 Triple-Expansion Engines of 540,000 H.P. INDCT. TOTAL.
50 Dredgers of different systems.
1,000 Locomotives, among them
250 Compound Locomotives.

THE AILSA SHIPBUILDING CO.,
Shipbuilders & Repairers,
TROON, N.B.

Repairs of All Kinds to Ship, Engine and Boilers. Two Graving Docks.

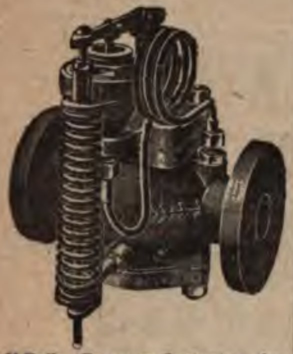
Telegraphic Address, "SHIPYARD, TROON." Telephone No. "13, TROON."

BEETON & CO.,
Commission Agents, Brokers, &c.
HOLT'S CHAMBERS,
121, PITT STREET,
SYDNEY, N.S.W.

IMPORTANT NOTICE.—Back Numbers of The Marine Engineer can be obtained of Mr. SEAGER, Bookseller, East India Road, London; JOHN ADAMS, Bookseller, 49, Oxford Street, Southampton; G. W. LENNOX, Bookseller, James Street, Docks, Cardiff; WILLIAM INNES, Bookseller, 40, Hamilton Street, Greenock; WILLIAM LOVE, Bookseller, Argyle Street, Glasgow; Wm. BUCHANAN, Bookseller, 13, Paisley Road, Glasgow; JOHN MENZIES & CO., Booksellers, Edinburgh and Glasgow; PHILIP, SON, & NEPHEW, Booksellers, South Castle Street, Liverpool; CRIPPS & HARROP, Booksellers, 36, Cable Street, Liverpool; C. C. ROSS, Bookseller, 35, Side, Newcastle-on-Tyne; Mr. ANNANDALE, Bookseller, Queen Street, Hull; THOS. REED & Co., Booksellers, 184, High Street West, Sunderland; ECKARDT & MESSTORFF, Booksellers, Hamburg; M. J. MINIERI, 3, Kaasbrug, Antwerp; SPON & CHAMBERLAIN, Booksellers, 12, Cortland Street, New York, Z. P. Maruya & CO., 14, Nihonbashi Tori Sanchome Tokyo, Japan, &c., &c.

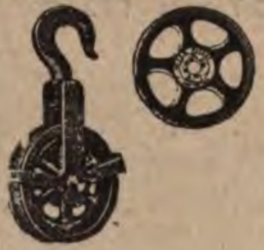
REID'S SPECIALITIES.

AUTOMATIC REDUCING VALVE.



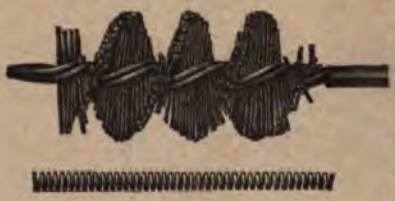
If Boiler Pressure fluctuates, the reduced side does not vary.

SELF-OILING PULLEYS.



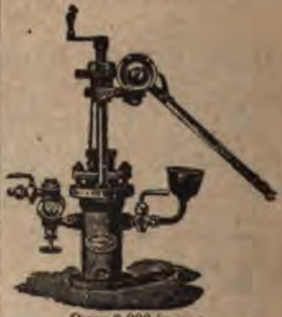
Lasts from one to two years without any cost for repairs; price about as cheap as ordinary blocks.

SPRING-COIL TUBE BRUSH.



Lasts six times longer than any other brush and costs about same.

AUTOMATIC SIGHT-FEED LUBRICATOR.



Over 6,000 in use.
No more cut Slide Valve faces

Before specifying for new work or ordering, intending buyers should first obtain circulars and full particulars of above from

WILLIAM REID & CO.,
112, FENCHURCH ST., LONDON, E.C., & 1, AKENSIDE HILL, NEWCASTLE-on-TYNE.

McINNES'S

ANTI-CORROSIVE & ANTI-FOULING COMPOSITIONS
FOR SHIPS' BOTTOMS.

As used by the Principal Companies at Home and Abroad. Contractors to the Admiralty.

SOLE MANUFACTURERS—
JOHN McINNES & SON, 13, North John Street, Liverpool.
Telegraphic Address—COMPOSITIONS, LIVERPOOL.
London Branch—146, FENCHURCH STREET, E.C.

ENGINEERS
Will find
SNOWDRIFT
LUBRICANT
(formerly known as BELL'S ASBESTOLINE), the most efficient, satisfactory, and cheapest of all Lubricants. 1 cwt. does the work of 1 ton of Olive or Castor, or 2 tons of Mineral Oil.
MANCHESTER—41, Corporation Street, C. H. Berry.
LIVERPOOL—2, Strand Street, Berry & Smith.
NEWCASTLE-ON-TYNE—2, Side, W. F. Snowdon.
BIRMINGHAM—88, Great Charles Street, W. M. Fuller, Jr.

THOMAS RAY,
PALLION FORGE,
SUNDERLAND.
FORGE DEPARTMENT—
SHIPS' STERN FRAMES, RUDDER & KEEL BARS;
SHAFTING HAMMER BARS & PISTON RODS.
GAS ENGINES from 1 MAN to 2 HORSE POWER.
FOUNDRY DEPARTMENT—
FURNACE BARS & DOORS, MANHOLE COVERS, AND GENERAL CASTINGS.

S. T. TAYLOR & SONS,
SCOTSWOOD-ON-TYNE.
Nat. Tel. No., 65. Telegrams, "Compo," Scotswood-on-Tyne.
Manufacturers of
NON-CONDUCTING BOILER COVERINGS,
For Boilers, Pipes, and all other Heated Surfaces.
ALSO "TAYLORS' PATENT"
REMOVABLE
ASBESTOS MATTRESSES
FOR BOILERS.
VULCAN CEMENT For Steam Joints
ELASTIC CEMENT For Boiler Seams.
"VULITE" BOILER DISINCRUSTANT FLUID.

JAMES HOWDEN & CO., ENGINEERS, GLASGOW.
LONDON OFFICE: 22, BILLITER STREET, E.C.
Telegrams HOWDEN, GLASGOW. TANGENTIAL, LONDON.
HOWDEN'S PATENT FORCED DRAUGHT
WITH THE LATEST PATENTED IMPROVEMENTS
Giving Increased Economy and Efficiency.
IN USE BY ALL THE PRINCIPAL STEAMSHIP COMPANIES AT HOME AND ABROAD.
FANS, ENGINES, RETARDERS.
TOTAL POWER OF STEAMERS FITTED.
2,500,000 I.H.P.

"GENETIC" BOILERS,

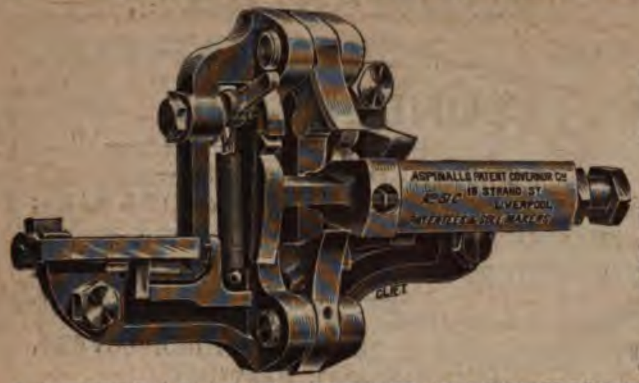
UNAPPROACHED FOR EFFICIENCY & DURABILITY,
Supplied to Messrs. Sir W. G. Armstrong & Co., Ltd., for a number of Warships, also to many of the Principal Engineering Firms and Steamship Owners throughout the World.

"SIMPLEX" STEAM PUMPS.
They are absolutely positive in their action.
Start from any position.

HORIZONTAL PATTERN.
Have no dead centre.
Are simple in construction.
Supplied from stock in all sizes, and for all duties.
Efficient in use.

VERTICAL PATTERN.
Excellent in Workmanship, and very low first cost.
The Cheapest Pumps in the Market.
STEAM MOTOR CAR VEHICLES OF EVERY DESCRIPTION.
SEND FOR DESCRIPTIVE PRICE LISTS, PARTICULARS AND DISCOUNTS TO
Manufacturers—T. TOWARD & Co., East Quay, Newcastle-on-Tyne.

TYNE IRON SHIPBUILDING COMPANY, LIMITED.
STEEL AND IRON SHIPBUILDERS AND REPAIRERS,
WILLINGTON-QUAY-ON-TYNE.
Telegraphic Address:—SHIPBUILDER, Willington-Quay.



ASPINALL'S PATENT
Marine Engine Governor

ADOPTED BY—
WHITE STAR, CUNARD, AMERICAN, NORTH GERMAN LLOYD, BRITISH INDIA, UNION, PACIFIC STEAM NAVIGATION, HAMBURG-AMERICAN, &c., &c.

Further particulars from the Patentees & Sole Makers—
ASPINALL'S PATENT GOVERNOR CO., 18, STRAND ST., LIVERPOOL.

PALMER'S
SHIPBUILDING AND IRON COMPANY, LIMITED,
JARROW-ON-TYNE.
The most extensive Shipbuilding Company in the World.

Manufacturers of every requisite in connection with the construction of Steamships.

MINE OWNERS & IRON ORE IMPORTERS.
MANUFACTURERS OF PIG-IRON.
MANUFACTURERS OF IRON & STEEL.
MAKERS OF MARINE ENGINES & BOILERS.
SHIPBUILDERS IN IRON & STEEL.
SHIP REPAIRERS.

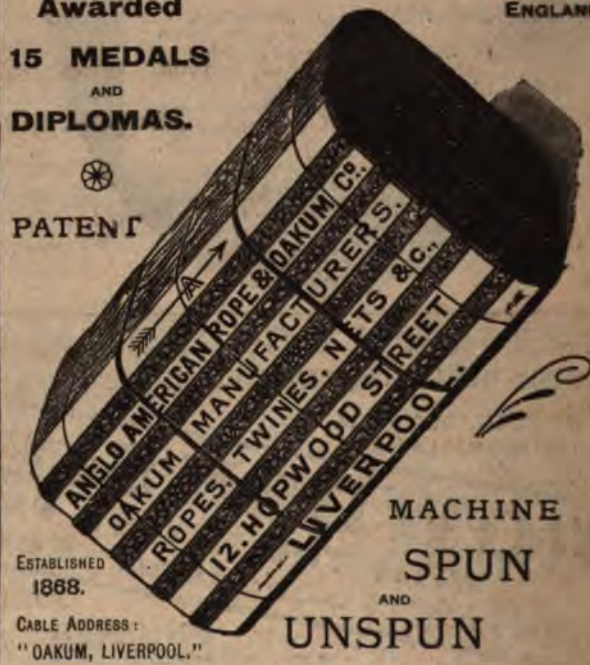
GRAVING DOCK—Length - - - - - - 440 ft.
Width of Entrance - - - - - - - - 70 „
Depth of Water on Sill & Blocks—Ordinary Spring Tides 18 „
Neap Tides - - 15 „
TENT SLIPWAY—Length - - - - - - 600 „

Works and General Offices—JARROW-ON-TYNE.
London Offices—30, GREAT ST. HELEN'S, E.C.
Newcastle Offices—H, KING STREET, QUAYSIDE.

Anglo-American Rope & Oakum Co.
LIVERPOOL,
ENGLAND.

Awarded
15 MEDALS
AND
DIPLOMAS.

PATENT


ANGLO AMERICAN ROPE & OAKUM Co.
OAKUM MANUFACTURERS.
ROPES, TWINES, NETS &c.
12, HOPWOOD STREET
LIVERPOOL.

ESTABLISHED
1868.

CABLE ADDRESS:
"OAKUM, LIVERPOOL."

MACHINE
SPUN
AND
UNSPUN
OAKUM.

J. B. TREASURE & Co.,
Excelsior Fire-Polished
GAUGE GLASSES,
LUBRICATORS,
INDIA-RUBBER WASHERS.
&c., &c.,
VAUXHALL ROAD,
LIVERPOOL.

LIVERPOOL.
A JURY OF LEADING ENGINEERS GAVE THE HIGHEST AWARD FOR
NON-CONDUCTING CEMENT
1886. *For Covering*
BOILERS, PIPES,
CYLINDERS, etc.,
TO THE
LIVERPOOL BOILER CEMENT COMPANY.

TRY OUR
STEAM JOINT
CEMENT
For Leaky Boilers.
And for making Steam or Water Joints.

References Supplied on application to
RICHD. P. DAVIS & Co.,
43-49, Hodson Street, LIVERPOOL.
Telegraphic Address: "NON-CONDUCTOR."

TRADE MARK.

Telephone, 86 EASTERN. Telegrams, "VOLUTE," LONDON.

SPECIAL ATTENTION GIVEN TO
COPPERSMITHS' WORK
TO PASS THE
ADMIRALTY AND BOARD
OF TRADE.

SUFFIELD & BROWN,

COPPERSMITHS, BRASSFOUNDERS, FINISHERS, &c.

MAKERS OF
EVAPORATORS,
FEED WATER HEATERS,
FRESH WATER CONDENSERS.

DOLPHIN LANE, POPLAR, LONDON, E.

J. G. MOORE & CO.,

ENGINEERS AND MILLWRIGHTS.
(OFFICES: 12, JOHN STREET.)

Vulcan Works, SUNDERLAND.

Makers of Moore's Patent Steam Hoist; Duplex and Centrifugal Pumps; High speed Engines; Launch Engines; Patent Boat Detaching Gear, and Exhibition Ships' Models and Fittings, &c.

ZYNKARA

(Protected by Letters Patent.)

SPECIALLY MANUFACTURED FOR THE PREVENTION OF PITTING AND CORROSION IN MARINE STEAM BOILERS.

Registered Offices:—34 & 36, SIDE, NEWCASTLE-ON-TYNE.

JAMES SPEEDING & CO.,

Ship Store Merchants, Colliery, & Engineers' Furnishers.

MAKERS OF SAILS, TARPAULINS, & WATERPROOF COVERS OF EVERY DESCRIPTION.

Offices, Works, and Warehouses } WHICKHAM STREET, MONKWEARMOUTH, SUNDERLAND.

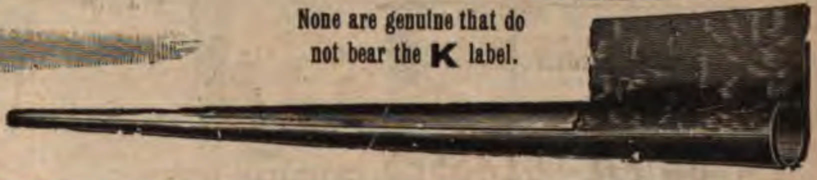
Telegrams: "SPEEDING, SUNDERLAND." *Telephone No. 270.*

KAYE'S PATENT STEEL SEAMLESS OIL CAN.

WITH PATENT SEAMLESS SPOUT.
JOS. KAYE & SONS, LTD.,
KAYE'S PATENT LOCK WORKS, LEEDS.
And at 93, HIGH HOLBORN, LONDON, W.C.

BEWARE OF
WORTHLESS
IMITATIONS.

None are genuine that do
not bear the **K** label.



Contractors to H.M. Navy, also to H.M. War Department and Home Office, for Indian States Railway, and other British Railway Companies.

Sample, post free, 2s.

WM. SIMONS & CO., LTD., RENFREW,

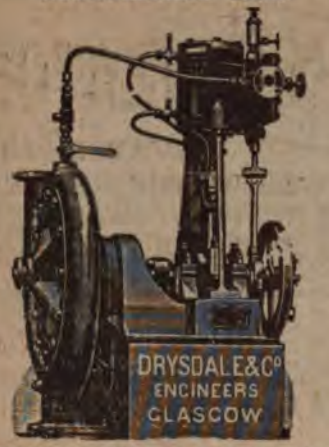
(ESTABLISHED 1810,)

ENGINEERS AND SHIPBUILDERS,

Constructors of STEAM VESSELS of all Descriptions.

IMPROVED DREDGE PLANT.

ESTABLISHED 1868.



CENTRIFUGAL PUMPS & PUMPING ENGINES.

For Docks, Circulating Purposes, Salvage Work, &c.

The cheapest and most efficient Pump in the Market.

From Newest and most Improved Pattern.

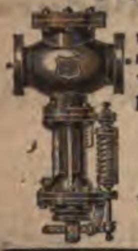
Specialities: Centrifugal Pumps, Fan Engines and High-speed Engines, Hydraulic Presses & Pumps, Hydraulic Cranes; Accumulators, Hydraulic Rivetters, Lifts of all kinds.

DRYSDALE & Co.,
Bon Accord Engine Works, GLASGOW.
Telegraph Address: BON ACCORD, GLASGOW.

AULD'S PATENT

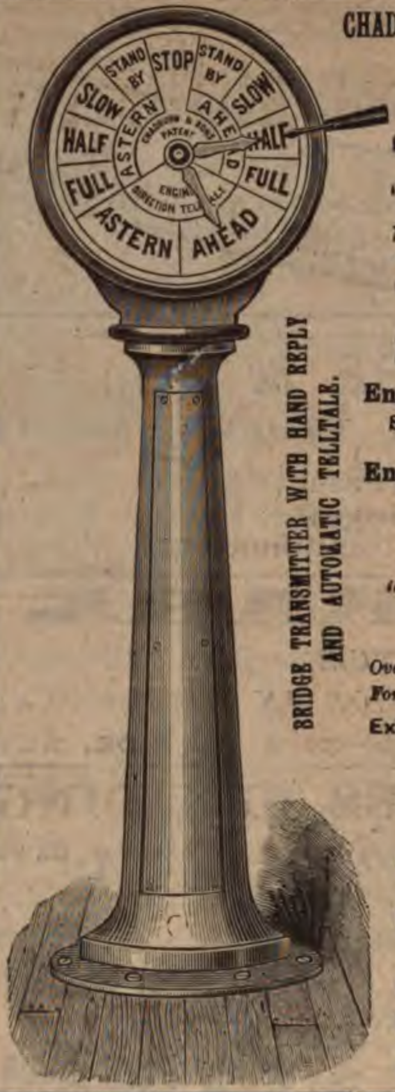
Steam Reducing Valves

FOR STEAM SHIPS.



These Valves are extensively used by Marine Engineers for supplying steam for purposes where it is required at a lower pressure than that in the boilers.

DAVID AULD & SONS,
Patentees and Makers,
WHITEVALE FOUNDRY,
GLASGOW.



BRIDGE TRANSMITTER WITH HAND REPLY AND AUTOMATIC TELLTALE.

CHADBURN'S (SHIP) TELEGRAPH CO., Ltd.,

LATE

CHADBURN & SON, LIMITED.

PATENT

"Duplex Gong" Telegraphs,

"LATEST IMPROVED" ENGINE TELEGRAPH.

Transmitter on Bridge. { *WITH HAND REPLY, Also, AUTOMATIC ENGINE REPLY.*

(Pointer showing on Bridge Dial Engines working Ahead or Astern.)

Indicator in Engine Room. { *WITH "DUPLEX GONGS." DEEP TONE for AHEAD, SHRILL TONE for ASTERN.*

Engine Automatic Direction Telltale,

Showing on Bridge Dial Engines working Ahead or Astern.

Engine Revolution Speed Indicator

Showing at a glance the Number of Revolutions per Minute.

STEERING TELEGRAPHS.

"LOOK OUT" TELEGRAPHS.

DOCKING TELEGRAPHS.

Over 4,000 Vessels Fitted, including British and Foreign Navies and Mail Steamers, Yachts, &c.

Exhibition Awards.—London, Paris, N.E. Coast, Amsterdam, Fisheries, Antwerp, Liverpool, and Havre.

TELEGRAPH WORKS—

11, Waterloo Road, Liverpool.

NEWCASTLE-ON-TYNE,
83, Quay Side.
GLASGOW, 4, Finnieston Quay.
BELFAST, 39, Donegal Quay.
LONDON, 105, Fenchurch Street.

BY ROYAL LETTERS PATENT.

HAY'S WATERPROOF (MARINE) GLUE

FOR COATING COMPOSITE SHIPS AND CAULKING SHIPS' DECKS,

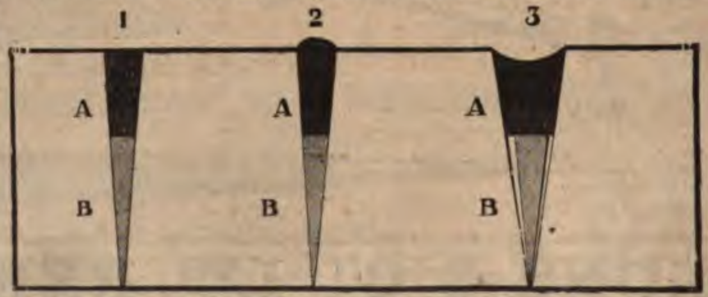
As used in H.M. Naval Yards, and all the Foreign Yards; by the P. & O., Union, and Inman Lines of Steamships, and by all the Ship and Yacht Builders in the World.

SECTION OF DECK SHOWING APPLICATION OF HAY'S MARINE GLUE.

1. The Glue as first applied (A).

Oakum driven home in the usual way (B).

2. The Glue when contracted by swelling of the wood (A).



3. The Glue when expanded by the heat of the sun (A).

(B) Showing that although wood contracts and leaves the Oakum, the Glue keeps its hold, and secures soundness of the seam.

BRILLIANT BLACK PROTECTIVE VARNISHES, &c.

SOLE MAKERS:

HAY'S WATERPROOF GLUE COMPANY, Limited.

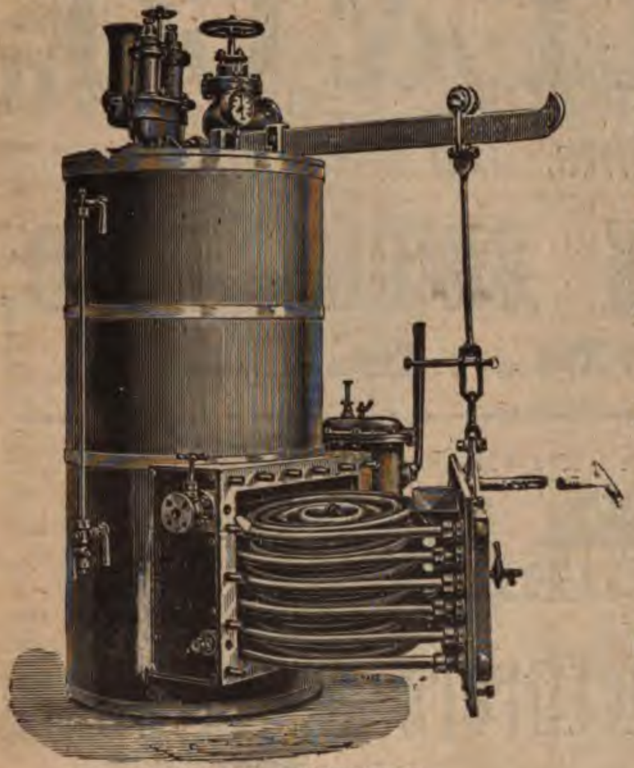
LANDPORT, PORTSMOUTH.

Agents, who keep Stock:—Glasgow: Captain A. SMITH, 12, York Street.
Newcastle-on-Tyne: WASTENEYS SMITH, 60, Sandhill. Liverpool: Messrs. MANUFACTURERS AGENCY CO.,
9, Litherland Alley, South Castle Street. Hamburg: W. H. CARR, Admiralitatstrasse 52.

PRICES, TERMS AND TESTIMONIALS ON APPLICATION.

N.B.—As there are several WORTHLESS IMITATIONS now offering, Customers are earnestly requested to obtain their supplie *direct from* the Company or their Agents and to see the registered Trade Mark is on each package.

RAYNER'S PATENT AUTOMATIC EVAPORATOR.



OPEN FOR INSPECTION.

All Heating Surfaces Solid Drawn Tube.
All Joints Metallic.

HEATING COILS
ARE
SELF-CLEANING
Continued Efficiency Guaranteed.

COMBINED EVAPORATORS & WINCH
EXHAUST CONDENSERS.

Live and Exhaust Steam Feed
Water Heaters.
Condensers and Distilling Plants of any capacity.

CONTRACTORS TO BRITISH AND FOREIGN ADMIRALTIES.

SOLE MAKERS,
CAIRD & RAYNER,
777, COMMERCIAL ROAD,
LIMEHOUSE, LONDON, E.
Telegraphic Address—"Vaporize, London." Telephone No.—5210

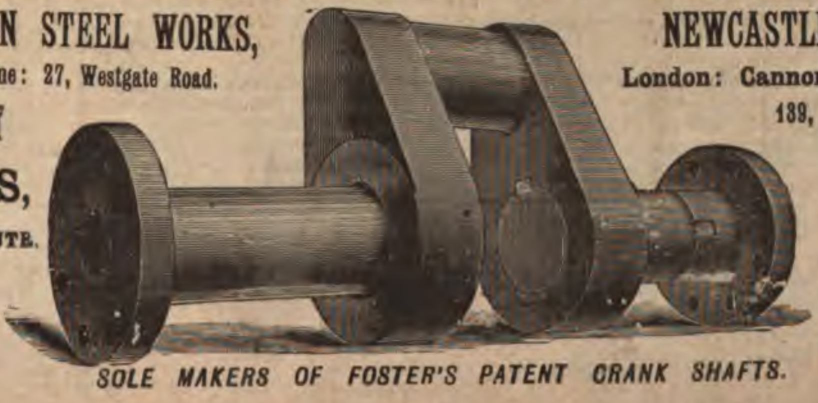
PENARTH SHIP BUILDING AND SHIP REPAIRING CO., LTD.,
National Telephone, No. 14. **PENARTH DOCK.** Telegraphic Address: "SLIPWAY, PENARTH."
Shipbuilders, Engineers, Boilermakers, Blacksmiths, Coppersmiths, Tinsmiths, Plumbers, &c.

SLIPWAY capable of taking up Vessels 300 ft. long and 2,400 tons gross register.
GRIDIRON, 374 ft. long, and capable of taking on Vessels 4,000 tons gross register. Railway Siding into the Yard.

ALL CLASSES OF REPAIRS EXECUTED WITH ECONOMY AND DESPATCH.

JOHN SPENCER & SONS,
NEWBURN STEEL WORKS, NEWCASTLE-ON-TYNE.
Offices, Newcastle-on-Tyne: 27, Westgate Road.
London: Cannon St. Buildings,
139, CANNON STREET, E.C.

Manufacturers of
SPRINGS,
LAMINATED, VOLUTE.
Conical, Spiral,
BUFFERS
Wrought and
Cast Iron.



SOLE MAKERS OF FOSTER'S PATENT CRANK SHAFTS.

STEEL,
By the Siemens'
Cementation and
Crucible Processes.
INGOTS, SLABS.
BILLETS & BARS
of All Sizes.

WRIGHT & CO.,

Engineers, Millwrights, and Machinists,

157, SOUTHWARK BRIDGE ROAD,

LONDON, S.E.,

NOW PUBLISHED. 13th EDITION.

PRICE 30/-

KELLY'S DIRECTORY

OF THE

Merchants, Manufacturers & Shippers

For 1899,

BEING

A Guide to the Export, Import, and Manufacturing Industries of the World.

WITH WHICH IS AMALGAMATED STREET'S INDIAN AND COLONIAL DIRECTORY.

THIS Work was originally issued every Three years, but the demand for it has been so steady and continuous that it has been found necessary to issue it Annually.

As in former Editions, the Work contains lists of the

IMPORTERS, EXPORTERS, MERCHANTS and MANUFACTURERS of GREAT BRITAIN and IRELAND, AND THE PRINCIPAL TRADING CENTRES OF THE WORLD.

Divided into **2 Divisions,** Foreign and Home.

The First Division embraces the British Colonies and possessions throughout the World, and the various Foreign Countries and their Colonies to which British Manufactures are exported, arranged under following Heads:—

INDIAN AND COLONIAL POSSESSIONS.	EUROPE (CONTINENTAL).	ASIA.
	AMERICA, NORTH & SOUTH.	AFRICA.

With each Country will be found a concise statistical account of its financial position, the ports and principal towns, with a short topographical account of each, together with classified list of the *Consuls, Bankers, Merchants, Commission Merchants, Brokers, and Shipping Agents,* and others who are *Buyers of British Goods,* and also the *Manufacturers of Goods Exported.*

The Second Division of the Work embraces the names and addresses of the actual Manufacturers in the United Kingdom of the articles exported, classified in the usual way, describing as clearly as possible the specialities of each Manufacturer. Lists are also given of the Merchants and Shippers who export British Goods; also Manufacturers who have either depots abroad or Consignees to whom they ship their own goods, will be included in this list and indicated by a special mark.

This part of the Work will be of great value to Buyers abroad, and also to the Merchants in this Country, by putting them in communication with the actual Manufacturers of such goods as are required abroad: while to Manufacturers it will be valuable, as showing them the Merchants and Shippers to the various Countries with which they may desire to do business.

The Trade Mark Section, as in the last Edition, is printed on coloured paper, and the Publishers feel that they cannot too strongly point out to Traders the importance of making their Trade Marks well known, and so avoiding the misleading imitations with which some of the Foreign Markets are flooded.

LONDON: KELLY'S DIRECTORIES LIMITED,
PUBLISHING AND PRINTING OFFICES, 182, 183, AND 184, HIGH HOLBORN, W.C.
Printing Offices: MIDDLE MILL, KINGSTON-ON-THAMES.

BRANCH OFFICES—

BIRMINGHAM: 13, TEMPLE ST. | SHEFFIELD: CENTRAL CHAMBERS, HIGH ST. | MANCHESTER: 37, BROWN ST. | LIVERPOOL 10A, SOUTH CASTLE ST.,
LEEDS: IMPERIAL BUILDINGS, 28, BOND ST., | GLASGOW: 137, WEST REGENT ST., | PARIS: 45*bis*, RUE DES SAINTS PERES.
HAMBURG: KELLY & CO., 2te BRANDSTWIETE, 8a.

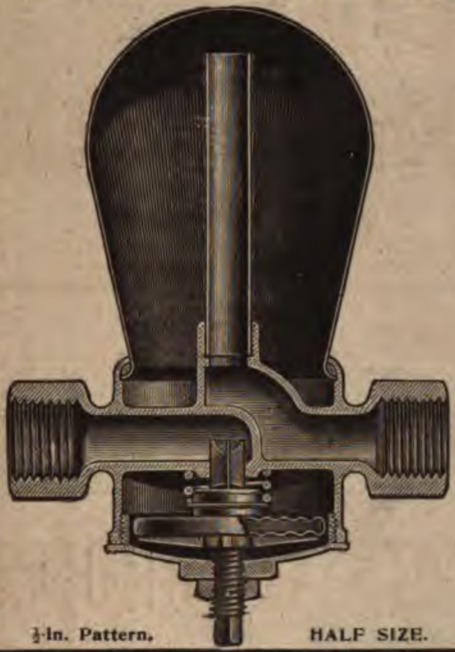
AGENTS—

CANADA—794, *Dovercourt Road, Toronto;* LOVELL & Co., Montreal.
BRITISH INDIA—THACKER & Co., LIMITED, Bombay & Calcutta.
MALTA—TURNBULL, JR. & SOMERVILLE, 20, Strada Reale, Valetta.
AUSTRALIA—HENRY WISE & Co., Melbourne & Sydney.
NEW ZEALAND—HENRY WISE & Co., Dunedin.
SOUTH AFRICA—DENNIS EDWARDS & Co., Cape Town

☞ USED BY HER MAJESTY'S GOVERNMENT AND THE

SPECIALLY ADAPTED FOR MARINE WORK ON ACCOUNT OF COMPACTNESS. Note Illustration.

THE RESERVOIR STEAM TRAP.



½-in. Pattern. HALF SIZE.

PATENTED ALL OVER THE WORLD.

Wide open when Cold. Never fails. Never wears out.

SMALLEST AND NEATEST IN THE WORLD.

GUN-METAL BODY WITH COPPER DOME,
CONSEQUENTLY NO CORROSION.

PERFECTLY AUTOMATIC.

THOUSANDS IN CONSTANT USE.

SENT ON APPROVAL.

Send for Price List to—

J. ARMSTRONG & Co., Ld.,
AGENTS FOR GREAT BRITAIN,
116, QUEEN VICTORIA ST., LONDON, E.C.

☞ PRINCIPAL RAILWAY AND SHIPPING COMPANIES.

BOILER SOLVENT (ZINCATE OF SODA),

FOR MARINE BOILERS.

PREVENTS PITTING, CORROSION, & SCALE.

NO CHIPPING REQUIRED. NO ZINC PLATES REQUIRED. GIVES ECONOMY OF FUEL, AND NEVER FAILS.

☞ CONDENSER DETERGENT. ☜

FOR CLEANING SURFACE CONDENSERS WITHOUT REMOVING THE TUBES. Specially adapted for Marine purposes.

"EUCALENE" DISINFECTING FLUID.

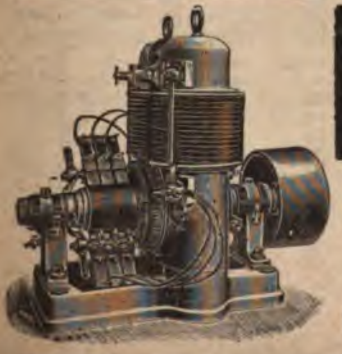
A VERY EFFICACIOUS COMPOUND FOR CABINS AND BERTHS OF STEAMERS.

ESTABLISHED 1885.

ANGLO-AMERICAN BOILER SOLVENT CO.

Works: RUNCORN, CHESHIRE.

Only Prize Medal granted at the Liverpool International Exhibition for "BOILER COMPOSITION."
Prices and Terms on Application.



THE "CASTLE"

SLOW SPEED,
HIGH EFFICIENCY.

DYNAMOS

J. H. HOLMES & CO.,
NEWCASTLE-ON-TYNE,
AND
17, SOHO SQUARE, LONDON, W.

CHAS. CAMMELL & CO.

LIMITED.

Derwent Iron and Steel Works, WORKINGTON, Cumberland. Yorkshire Steel and Iron Works, PENISTONE, near Sheffield.
Grimesthorpe Ordnance Steel, Tyre, and Spring Works, SHEFFIELD. Old and New Oaks Collieries, BARNSLEY.

CYCLOPS STEEL AND IRON WORKS, SHEFFIELD, ENGLAND.

London Office: **26, PARLIAMENT ST., WESTMINSTER, S.W.**

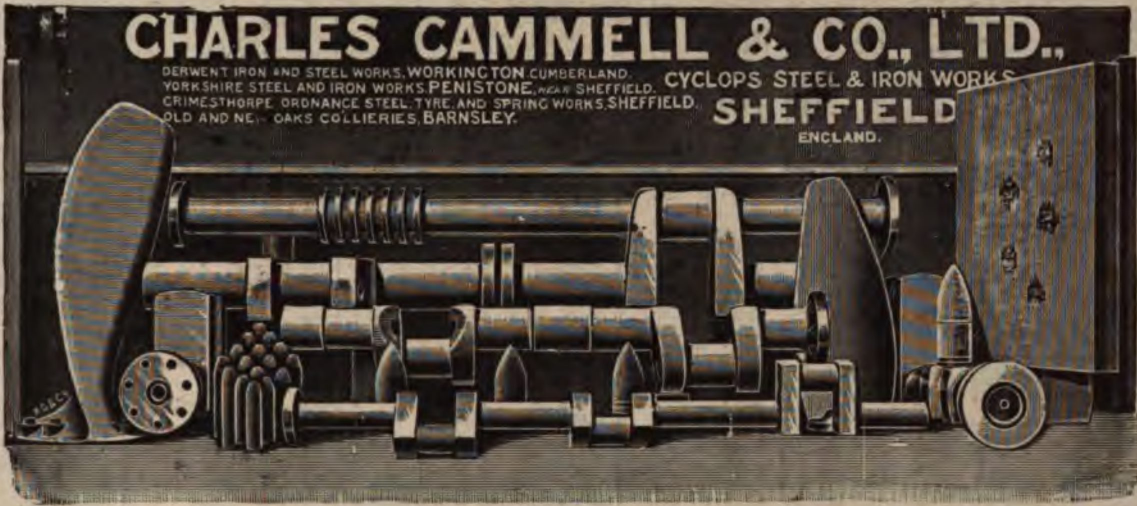
MANUFACTURERS OF

BEST TOUGHENED BESSEMER STEEL

RAILS.

MILD STEEL

FISH-PLATES
OR
SPLICE BARS.


CHARLES CAMMELL & CO., LTD.,
DERWENT IRON AND STEEL WORKS, WORKINGTON CUMBERLAND.
YORKSHIRE STEEL AND IRON WORKS PENISTONE, NEAR SHEFFIELD.
GRIMESTHORPE ORDNANCE STEEL, TYRE, AND SPRING WORKS, SHEFFIELD.
OLD AND NEW OAKS COLLIERIES, BARNSLEY.
CYCLOPS STEEL & IRON WORKS
SHEFFIELD
ENGLAND.

CAST STEEL ORDNANCE FORGINGS.

CRANK & PROPELLER SHAFT, CONNECTING ROD, PISTON ROD AND OTHER

MARINE FORGINGS.

CAST, SHEAR, GERMAN, SPRING, AND BLISTER STEEL. TILGHMAN'S PATENT SAND-BLASTED FILES, POINTS, SWITCHES, AND CROSSINGS.

THE CELEBRATED BEST REFINED CAST STEEL* FILES, *Marked "CAMEL" and "CYCLOPS."

SOLID STEEL, NICKEL STEEL, and "HARVEYED" STEEL ARMOUR PLATES.

ORDNANCE, MARINE, LOCOMOTIVE AND OTHER **CASTINGS** OF ANY SIZE OR PATTERN.

Locomotive Crank and Straight **AXLES.** Connecting, Coupling and Piston **RODS,** Crank Pins, &c., &c. Solid Weldless Crucible, Siemens-Martin and Bessemer Steel **TYRES.** Bearing, Buffing and Spiral **SPRINGS and BUFFERS** of every description.

MILD STEEL BOILER AND SHIP PLATES.

Trade Mark—
"BITUMASTIC."

PATENT

BY ROYAL
LETTERS PATENT.

"BITUMASTIC" ENAMELS

APPROVED BY THE

ADMIRALTY,
LLOYD'S,
BUREAU VERITAS,
BRITISH CORPORATION,
AND OTHER
CLASSIFICATION SOCIETIES.

Recommended to keep up Classification. | **Recommended to keep down Repairs and Renewals.**

ECONOMICAL.
PERMANENT.
MODERATE COST.

SPECIFICATION STRONGLY RECOMMENDED TO AVOID SPURIOUS IMITATIONS.

WAILES, DOVE & CO.'S PATENT **"BITUMASTIC"** COATINGS for Bunkers, Tank Tops, Floors in Cellular Bottoms, Peaks, etc. Carefully, efficiently, and promptly applied hot by thoroughly experienced men.

STOCKS, RESIDENT WORKMEN, AND PLANT AT ALL CHIEF PORTS.

W. D. & CO.'S PATENT "BITUMASTIC" SOLUTION is used and applied the same as ordinary paint, but of almost permanent durability in comparison on exposed or internal surfaces. Largely used for DECKS, throughout HOLDS, etc., by the most important Lines: Orient, Castle, Union, American, Cunard, White Star, Shaw Savill, Pacific, Royal Mail, etc.

Wailes, Dove & Co., Ltd.

Head Offices: NEWCASTLE-ON-TYNE.

Nat. Telephone No. 1122, G.P.O. No. 618; Branch Offices, etc., at

LONDON
35, LIME ST., E.C.
Tel. No. 987 Avenue.

GLASGOW:
45, WEST NILE ST.
Tel. No. 4981.

CARDIFF:
12, MT. STUART SQ.
Tel. No. 245.

LIVERPOOL:
25, WATER STREET.
Tel. No. 6713.

PHILADELPHIA,
U.S.A.:
311½, WALNUT ST.

PHOSPHOR COG WHEEL BRAND. **BRONZE**

The Best Metal for every description of Bearing,
Bushes, Slide Valves, Slide Faces, Propellers,
Cylinders, Piston Rings, Eccentric Straps,
Hydraulic Pumps, Valves, Liners, &c.

PHOSPHOR BRONZE COMPANY LIMITED "VULCAN."

Cog Wheel Brand Phosphor Tin and Phosphor Copper, the best quality made.

WHITE ANTIFRICTION ALLOYS OF ALL KIND

THE PHOSPHOR BRONZE COMPANY, LIMITE

Chief Foundry—87, SUMNER STREET, SOUTHWARK, LONDON, S.E.

WORTHINGTON PUMPING ENGINE CO.

153, QUEEN VICTORIA STREET, LONDON, E.C.

TELEPHONE: No. 614, BANK.

WORTHINGTON. TRADE MARK.

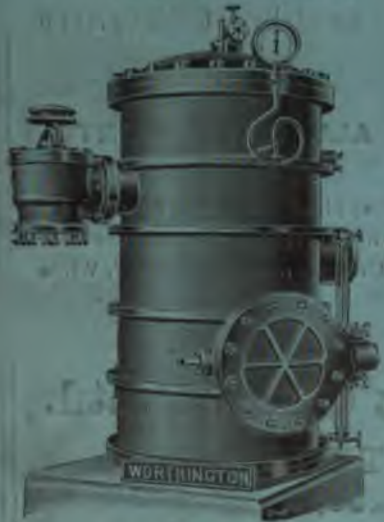
TELEGRAMS: "PUMPING, LONDON."

WORTHINGTON FEED-HEATER

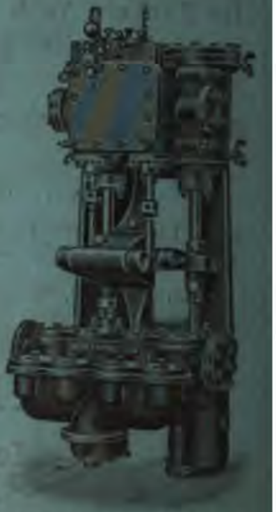
Pumps for all Marine Service.

VERTICAL OR HORIZONTAL
WITH
GUN-METAL OR IRON WATER-ENDS

800 MARINE PUMPS
IN STOCK.



WORTHINGTON FEED WATER HEATER.



VERTICAL MARINE FEED PUMP.

Catalogues and Particulars on Application.

Printed for the Proprietors by PERRY, GARDNER & Co., Foresters' Hall Place, Clerkenwell Road, in the County of Middlesex, and Pu
the Office, 3, Amen Corner, Paternoster Row, in the Parish of Christ Church, in the City of London.—April 1st, 1899.

PUBLIC LIBRARY
ASTOR, LENOX AND TILDEN FOUNDATIONS

No. 252. Vol. XXI. MARCH 1, 1900. PRICE 6d., by Post, 8d.

THE MARINE ENGINEER:

A MONTHLY JOURNAL OF MARINE ENGINEERING, SHIPBUILDING & STEAM NAVIGATION.

OFFICES: 3, AMEN CORNER, PATERNOSTER ROW, LONDON, E.C.

Efficiency superior to any hitherto brought out

THORNYCROFT PROPELLERS

Designers and Makers
J.I. Thornycroft & Co., Chiswick, London.

PHOSPHOR BRONZE
(Cog Wheel and Vulcan Brands).
ANTIFRICTION ALLOYS.
(See Advt. back of Cover).

ROSS & DUNCAN,
Marine Engineers and Boiler Makers,
WHITEFIELD WORKS, GLASGOW.
BREMME'S PATENT VALVE GEAR,
DUNCAN'S PATENT PROPELLER.
Contractors for Steam Vessels of all Kinds.
ON ADMIRALTY LIST.

JOHN WILKES, SONS & MAPPLEBECK, LTD.
BIRMINGHAM.
MANUFACTURERS OF
BRASS AND COPPER TUBES
For Locomotive and Marine Boilers, Condensers, &c.
METALS, WIRE, &c.

TUCKS "TRIPLE" METALLIC PACKING.
See Advertisements
PAGES viii. & xxi.

BEALL'S DEVIASCOPE,
As used by the Board of Trade.
A model practically illustrating the Deviation of the Compass, showing all the various co-efficients and their compensation.

Handbook to the above - - - - One Shilling.
SOLE MANUFACTURERS:
H. HUGHES & SON, Marine Opticians,
59, FENCHURCH STREET, LONDON.

New Edition. Now Ready 12/6.
Contains complete sets of new Questions just issued.

BERGEN'S MARINE ENGINEER
AND GUIDE BOOK TO THE BOARD OF TRADE EXAMINATION.
Text profusely illustrated. 50 large new and valuable Plates to illustrate Parts of Engines.
W. J. POTTS, NORTH SHIELDS.

HOLZAPFEL'S COMPOSITIONS COMPANY, Ltd.,
International Antifouling Composition, &c. See page v.

MAGNOLIA ANTI-FRICTION METAL
Has been proved by Experts to Show from 35 to 53 per cent.
LESS FRICTION
than its Competitors.
None Genuine except with our Trade Mark stamped on each Ingot and Box.
MAGNOLIA ANTI-FRICTION METAL Co.
of Great Britain, Limited,
49, Queen Victoria St., London, E.C.
Telegraphic Address: "Magnolier, London."
Telephone 5925 Bank.

TO INVENTORS.
E. P. ALEXANDER & SON,
(Fel. Chartered Inst. Patent Agents),
19, Southampton Buildings, Chancery Lane, W.C.
All business relating to British and Foreign Patents, Designs and Trade Marks transacted on moderate Terms. Pamphlet and General Advice Gratis.
Telegrams, "EPA, LONDON."
ESTABLISHED 18 YEARS.

STRONGEST MALLEABLE BRONZE
DELTA METAL
PROPELLERS AND PROPELLER BLADES, PUMP RODS, STUDS, BOLTS & NUTS, PLATES, TUBES, WIRE. RODS of any SECTION.
Large Stocks at LONDON, LIVERPOOL, and GLASGOW.
THE DELTA METAL CO., LD.,
110, CANNON STREET, LONDON, E.C.
Contractors to the Admiralty, War Office, India Office, and various Foreign Governments.

IRON TUBES STEEL
LLOYD & LLOYD, LTD.,
BIRMINGHAM.

PATENTS,
DESIGNS. TRADE MARKS.
WHITE & WOODINGTON.
Rooms: 221—225, Birkbeck Bank Chambers, Southampton Buildings, London.
31 *Years' Experience. Highest References.*
MARINE SUBJECTS A SPECIALITY.

"BITUMASTIC." See Page xxxvii.

CRANE'S OILS
FOR MARINE USE.
CYLINDER & ENGINE OILS.
29, Fenchurch Street, London

THE CITY PATENT AGENCY FOR MARINE PATENTS.
J. C. FELL, Fel.Chr.Inst.P.A., Wh.Sc., M.I.M.E.,
R. W. JAMES, Fel.Chr.Inst.P.A., A.M.I.C.E., M.I.M.E.
(Late Fell & Wilding)
Patents, Trade Marks, and Designs in all countries. Best Technical, Scientific and Legal Advice. Searches made. Address any enquiries to FELL & JAMES, 1, Queen Victoria Street, London, E.C.

H. HUGHES AND SON'S COMPLET SALINOMETER. This very complete for of Salinometer comprises an improved copper pot with a long wooden handle, to prevent scaldin when drawing off, a gilt metal Salinometer, a glas ditto, and Thermometer, the whole of which pack i the copper pot when not in use. Price, complet with directions, 28s.—59, Fenchurch Street, London

---

THE BROUGHTON COPPER CO. LTD
MANCHESTER.
Copper Smelters and Manufacturers of
COPPER, BRASS & BRONZE TUBE
For Marine, Locomotive, and other Purposes.
INGOTS, RODS, SHEETS, PLATES, &c.
ELECTRO-COPPERING ALLOYS.

TUBES! IRON & STEEL BOILE TUBES,
OF SUPERIOR QUALITY.
JAMES EADIE & SONS,
CLYDESDALE TUBE WORKS,
RUTHERGLEN, near GLASGOW
Prices and Discounts on application.

NEW EDITION. THE 16TH
Containing NEW QUESTIONS just issued and Paper
REED'S ENGINEERS HAND-BOOK
TO THE
BOARD OF TRADE EXAMINATIONS.
Illustrated by 344 Diagrams, and 36 Plates o parts of Engines. 14s. post free.
THE KEY to the same, price 7s. 6d., post free
SUNDERLAND: THOMAS REED & Co.,
184, HIGH STREET WEST.
See page x for particulars.

MAY 1 8 1932